SOIL SURVEY

Madison County Indiana

UNITED STATES DEPARTMENT OF AGRICULTURE
Soil Conservation Service
In cooperation with
PURDUE UNIVERSITY AGRICULTURAL EXPERIMENT STATION

Issued March 1967

Major fieldwork for this soil survey was done in the period 1959–61. Soil names and descriptions were approved in 1965. This survey was made cooperatively by the Soil Conservation Service and the Purdue University Agricultural Experiment Station. It is a part of the technical assistance furnished to the Madison County Soil Conservation District.

HOW TO USE THIS SOIL SURVEY

THIS SOIL SURVEY of Madison County, Ind., contains information that can be applied in managing farms and woodlands; in selecting sites for roads, ponds, buildings, or other structures; and in appraising the value of tracts of land for agriculture, industry, or recreation.

Locating Soils

All the soils of Madison County are shown on the detailed map at the back of this survey. This map consists of many sheets that are made from aerial photographs. Each sheet is numbered to correspond with numbers shown on the Index to Map Sheets.

On each sheet of the detailed map, soil areas are outlined and identified by symbol. All areas marked with the same symbol are the same kind of soil. The soil symbol is inside the area if there is enough room; otherwise, it is outside and a pointer shows where the symbol belongs.

Finding and Using Information

The "Guide to Mapping Units" can be used to find information in the survey. This guide lists all of the soils of the county in alphabetic order by map symbol. It shows the page where each kind of soil is described and the page for the capability unit in which the soil has been placed. It also lists the woodland suitability group of each soil.

Individual colored maps showing the relative suitability or limitations of soils for many specific purposes can be developed by using the soil map and information in the text. Interpretations not included in the text can be developed by grouping the soils according to their suitability or limitations for a particular use. Translucent material can be used as an overlay over the soil map and colored to show soils that have the same limitation or suitability. For example, soils that have a slight limitation for a given use can be colored green, those with a moderate limitation can be colored yellow, and those with a severe limitation can be colored red.

Farmers and those who work with farmers can learn about use and management of the soils in the soil descriptions and in the discussions of the interpretative groupings.

Foresters and others can refer to the section "Woodland," where the soils of the county are grouped according to their suitability for trees.

Game managers, sportsmen, and others concerned with wildlife will find information about soils and wildlife in the section "Wildlife Management."

Engineers and builders will find under "Engineering Properties of Soils" tables that give engineering descriptions of the soils in the county and that name soil features that affect engineering practices and structures.

Scientists and others can read about how the soils were formed and how they are classified in the section "Formation and Classification of Soils."

Students, teachers, and others will find information about soils and their management in various parts of the text, depending upon their interest.

Newcomers in Madison County may be especially interested in the section "General Soil Map," where broad patterns of soils are described. They may also be interested in the section "Additional Information About the County."

***Cover picture.*—Blount soils in light-colored areas and Pewamo soils in dark areas. Corn on left and newly planted soybeans in middle. Corn and soybeans are the main crops in the county.**

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NOTICE TO LIBRARIANS
Series year and series number are no longer shown on soil surveys. See explanation on the next page.

Issued March 1967

EXPLANATION

Series Year and Series Number

Series year and number were dropped from all soil surveys sent to the printer after December 31, 1965. Many surveys, however, were then at such advanced stage of printing that it was not feasible to remove series year and number. Consequently, the last issues bearing series year and number will be as follows:

Series 1957, No. 23, Las Vegas and Eldorado Valleys Area, Nev.
Series 1958, No. 34, Grand Traverse County, Mich.
Series 1959, No. 42, Judith Basin Area, Mont.
Series 1960, No. 31, Elbert County, Colo. (Eastern Part)
Series 1961, No. 42, Camden County, N.J.
Series 1962, No. 13, Chicot County, Ark.
Series 1963, No. 1, Tippah County, Miss.

Series numbers will be consecutive in each series year, up to and including the numbers shown in the foregoing list. The soil survey for Tippah County, Miss., will be the last to have a series year and series number.

SOIL SURVEY OF MADISON COUNTY, INDIANA

BY EDWARD J. SCHERMERHORN, SOIL SCIENTIST, SOIL CONSERVATION SERVICE

FIELDWORK BY P. CARMONY, W. KIRKHAM, E. J. SCHERMERHORN, AND OTHERS[1], SOIL CONSERVATION SERVICE

UNITED STATES DEPARTMENT OF AGRICULTURE IN COOPERATION WITH PURDUE UNIVERSITY AGRICULTURAL EXPERIMENT STATION

MADISON COUNTY, in the east-central part of Indiana, has an area of 289,920 acres, or 453 square miles (fig. 1). The county is rectangular and extends 30 miles from north to south and 15 miles from east to west. The air distances from Anderson, the county seat, to principal cities in Indiana are shown in figure 1.

Farming, mainly of the cash-grain and livestock types, is the main enterprise in the county. The most common practice is to feed the crops to hogs and cattle and to market the livestock.

In the past few years, rural areas have been developed extensively in the county, especially around Anderson and Elwood. Although the use of soils for farming is emphasized in this report, attention is also given to nonfarm uses.

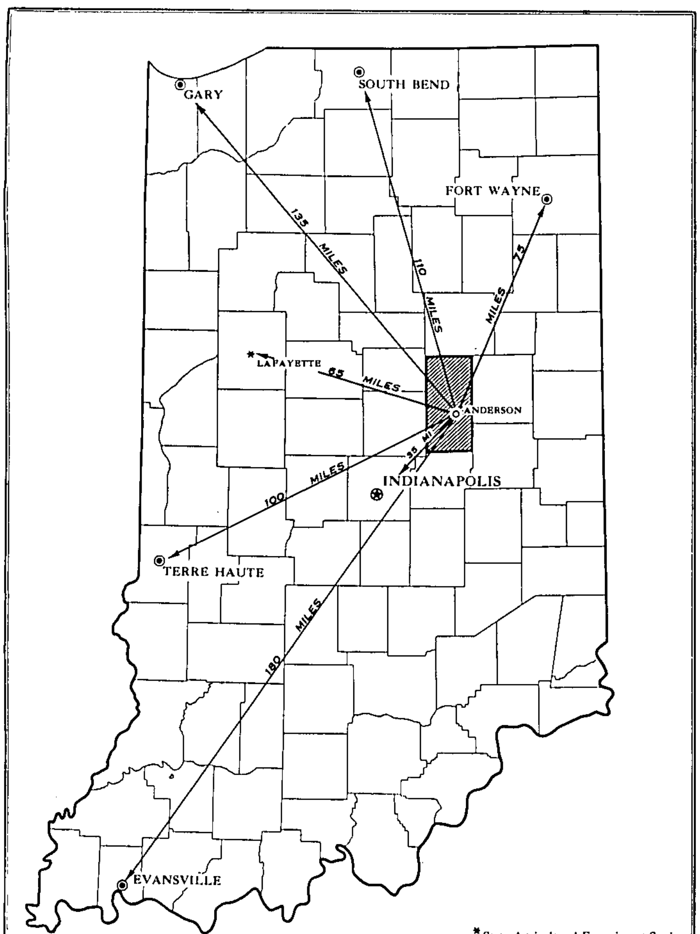

Figure 1.—Location of Madison County in Indiana.

How This Survey Was Made

Soil scientists made this survey to learn what kinds of soils are in Madison County, where they are located, and how they can be used.

They went into the county knowing they likely would find many soils they had already seen, and perhaps some they had not. As they traveled over the county, they observed steepness, length, and shape of slopes; size and speed of streams; kinds of native plants or crops; kinds of rock; and many facts about the soils. They dug many holes to expose soil profiles. A profile is the sequence of natural layers, or horizons, in a soil; it extends from the surface down into the parent material that has not been changed much by leaching or by roots of plants.

The soil scientists made comparisons among the profiles they studied, and they compared these profiles with those in counties nearby and in places more distant. They classified and named the soils according to nationwide, uniform procedures. To use this report efficiently, it is necessary to know the kinds of groupings most used in a local soil classification.

Soils that have profiles almost alike make up a soil series. Except for different texture in the surface layer, all the soils of one series have major horizons that are similar in thickness, arrangement, and other important characteristics. Each soil series is named for a town or other geographic feature near the place where a soil of that series was first observed and mapped. Eel and Fox, for example, are the names of two soil series. All the soils in the United States having the same series name are essentially alike in those characteristics that go with their behavior in the natural, untouched landscape. Soils of one series can differ somewhat in texture of the surface soil and in slope, stoniness, or some other characteristic that affects use of the soils by man.

Many soil series contain soils that differ in texture of their surface layer. According to such differences in texture, separations called soil types are made. Within a series, all the soils having a surface layer of the same texture belong to one soil type. Fox fine sandy loam and Fox silt loam are two soil types in the Fox series. The

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difference in texture of their surface layer is apparent from their names.

Some types vary so much in slope, degree of erosion, number and size of stones, or some other feature affecting their use, that practical suggestions about their management could not be made if they were shown on the soil map as one unit. Such soil types are divided into phases. The name of a soil phase indicates a feature that affects management. For example, Fox silt loam, 0 to 2 percent slopes, is one of several phases of Fox silt loam, a soil type that ranges from nearly level to moderately steep.

After a guide for classifying and naming the soils had been worked out, the soil scientists drew the boundaries of the individual soils on aerial photographs. These photographs show woodlands, buildings, field borders, trees, and other details that greatly help in drawing boundaries accurately. The soil map in the back of this report was prepared from the aerial photographs.

The areas shown on a soil map are called mapping units. On most maps detailed enough to be useful in planning management of farms and fields, a mapping unit is nearly equivalent to a soil type or a phase of a soil type. It is not exactly equivalent, because it is not practical to show on such a map all the small, scattered bits of soil of some other kind that have been seen within an area that is dominantly of a recognized soil type or soil phase.

In preparing some detailed maps, the soil scientists have a problem of delineating areas where different kinds of soils are so intricately mixed, and so small in size that it is not practical to show them separately on the map. Therefore, they show this mixture of soils as one mapping unit and call it a soil complex. Wallkill complex is a mapping unit made up of several kinds of Wallkill soils. Also, on most soil maps, areas are shown that are so shallow or so disturbed by wind, water, or man that they scarcely can be called soils. These areas are shown on a soil map like other mapping units, but they are given descriptive names, such as Gravel pits or Made land, and are called land types rather than soils.

While a soil survey is in progress, samples of soils are taken, as needed, for laboratory measurements and for engineering tests. Laboratory data from the same kinds of soils in other places are assembled. Data on yields of crops under defined practices are assembled from farm records and from field or plot experiments on the same kinds of soils. Yields under defined management are estimated for all the soils.

But only part of a soil survey is done when the soils have been named, described, and delineated on the map, and the laboratory data and yield data have been assembled. The mass of detailed information then needs to be organized in a way that it is readily useful to different groups of readers, among them farmers, managers of woodland, engineers, and homeowners. Grouping soils that are similar in suitability or limitations for each specified use is the method of organization commonly used in the soil survey reports. On basis of the yield and practice tables and other data, the soil scientists set up trial groups, and then test them by further study and by consultation with farmers, agronomists, engineers, and others. Then, the scientists adjust the groups according to the results of their studies and consultation. Thus, the groups that are finally evolved reflect up-to-date knowledge of the soils and their behavior under present methods of use and management.

General Soil Map

The general soil map at the back of this report shows, in color, the soil associations in Madison County. A soil association is a landscape that has a distinctive proportional pattern of soils. It normally consists of one or more major soils and at least one minor soil, and it is named for the major soils. The soils in any one association, may occur in another association, but in a different pattern.

A map showing soil associations is useful to people who want a general idea of the soils in a county, who want to compare different parts of the county, or who want to know the location of large tracts that are suitable for a certain kind of farming or other land use. Such a map is not suitable for planning the management of a farm or field, because the soils in any one association ordinarily differ in depth, stoniness, drainage, or other characteristics that affect management.

Madison County has seven soil associations. Soil associations 1, 2, 3, and 4 are on uplands of glacial till that range from level to steep. Soil association 5 consists of small areas on outwash plains, and soil association 6 is on terraces and bottom lands. Nearly level organic soils dominate in soil association 7.

1. Blount-Pewamo association: Nearly level and gently sloping soils formed in moderately fine textured till on uplands

Level and gently sloping uplands of glacial till dominate in this soil association. The glacial till is high in clay. This association is in the northeastern corner of the county and occupies approximately 57 square miles.

Intermingled in a fairly complex pattern are the dominant Blount and Pewamo soils (fig. 2). The Blount soils occupy 35 square miles and occur on nearly level and gently sloping rises and knobs. These soils are somewhat poorly drained. They are lighter colored than the Pewamo soils, have a dark yellowish-brown subsoil, and are underlain by grayish-brown limy till that is high in clay.

The Pewamo soils occupy 22 square miles and occur in nearly level to slightly depressional areas. These soils are very poorly drained. They have a dark-colored sur-

Figure 2.—**Blount and Pewamo soils in soil association 1. Blount soils are lighter colored and slightly higher than the Pewamo soils.**

face layer that contains more clay than the surface layer of the Blount soils. The grayish-brown subsoil of the Pewamo soils is underlain by gray limy till that is high in clay.

Almost all of this association is suitable for the crops commonly grown in the county. Artificial drainage and adequate fertilization are needed for maximum crop yields. Generally, applications of lime are needed on the Blount soils, but not on the Pewamo.

2. Morley association: Gently sloping and strongly sloping soils formed in fine-textured till on uplands

Breaks along Pipe, Mud, and Lilly Creeks in the northeastern part of the county make up this soil association. The association is within larger areas of Pewamo and Blount soils and includes small nearly level and depressional areas of those soils. This soil association occupies 9 square miles.

The dominant Morley soils are moderately well drained and well drained. They have a silty surface layer. Their subsoil and underlying limy till are high in clay.

Cultivated areas of the soils in this association are susceptible to erosion because slopes are gentle to strong and the content of clay is high. The Morley soils are acid and require periodic applications of lime. Also needed, if yields are to be favorable, is careful management, including additions of commercial fertilizer. The more gentle slopes are cultivated, and the steeper slopes are almost entirely in permanent pasture. Because slopes are short and uneven, terraces and contours are hard to establish and other conservation practices are hard to use.

3. Brookston-Crosby association: Nearly level and gently sloping soils formed in medium-textured till on uplands

This association is made up of nearly level to gently sloping rises and knobs that are interspersed with level and slightly depressional areas. In a few depressions plant remains have accumulated. This association occupies about 278 square miles, or more than half of the county, and occurs in almost all parts.

The Brookston and Crosby soils are dominant (fig. 3), but on some slopes, especially in the southern part of the county, there are small areas of Celina, Miami, and Fox soils. These small areas of minor soils total 49 square miles.

The Brookston soils occupy 111 square miles and occur in the nearly level and slightly depressional areas. These dark-colored, very poorly drained soils have a silty or clayey surface layer and a dark-gray clayey subsoil. They are underlain by grayish-brown to yellowish-brown, calcareous loamy till.

Crosby soils occupy 118 square miles and are on the nearly level to gently sloping rises and knobs. These soils are lighter colored than the Brookston soils and have less

Figure 3.—**Brookston and Crosby soils in soil association 3. The Crosby soils are higher and lighter colored than the Brookston.**

clay in the surface layer. They are somewhat poorly drained and have a dark yellowish-brown clayey subsoil underlain by yellowish-brown, calcareous loamy till.

The soils in this association are suited to all crops commonly grown in the county. Artificial drainage is needed on the Brookston and Crosby soils if yields are to be favorable. Although additions of lime are generally not needed on the Brookston soils, they are on the Crosby. Also needed is a good program for fertilization, especially on the Crosby soils.

4. Miami-Celina and Fox, till substratum, association: Gently sloping to steep soils formed in medium-textured glacial drift on uplands

Characterizing this association are breaks above the bottom lands and terraces along the major streams. Slopes are uneven and range from gentle to steep. The association is widely scattered and occurs in all parts of the county except the northern. It occupies 34 square miles.

In addition to the major soils in this association—the Miami, Celina, and Fox—there are Hennepin soils on steep slopes and Brookston and Crosby soils in nearly level areas. The Miami and Celina soils occupy about 21 square miles. They have a moderately dark colored silty surface layer and a dark-brown clayey subsoil. The underlying material is yellowish-brown loam to clay loam till. The Miami soils are well drained, and Celina soils are moderately well drained.

The Fox soils occupy about 13 square miles. They have a moderately dark colored silty surface layer and a dark reddish-brown subsoil. In some places a thin layer of sand and gravel overlies loamy till. Fox soils are well drained.

The soils in this association are susceptible to erosion if they are cultivated. The more gentle slopes are cultivated, but the steeper slopes are mostly in permanent pasture or trees (fig. 4). These soils are acid and require additions of lime. Fertilizer should be added in amounts indicated by soil tests.

5. Mahalasville-Sleeth association: Nearly level soils on outwash plains

This association is made up of level and nearly level outwash plains that have indistinct boundaries blending into the surrounding or adjacent associations. The soils developed in stratified silt and fine sand that contain thin layers of gravel or clay in a few places. The association is in a single area in the central part of the county and in four areas in the northwestern part. It occupies approximately 10 square miles.

The Mahalasville and Sleeth are the major soils in this association, but there are small areas of Kokomo soils. Mahalasville soils occupy about 9 square miles and occur in level or slightly depressional areas. These dark-colored soils are very poorly drained and have a silty or clayey surface layer. The dark-gray subsoil is clayey and is underlain by gray limy silt and fine sand. The Kokomo soils are similar to the Mahalasville soils but are in the more depressional areas.

The Sleeth soils occupy about 1 square mile and occur on nearly level to gently sloping rises and knobs. Their surface layer is lighter colored and contains less clay than that of the surrounding Mahalasville soils. Sleeth soils have a clayey subsoil and are somewhat poorly drained.

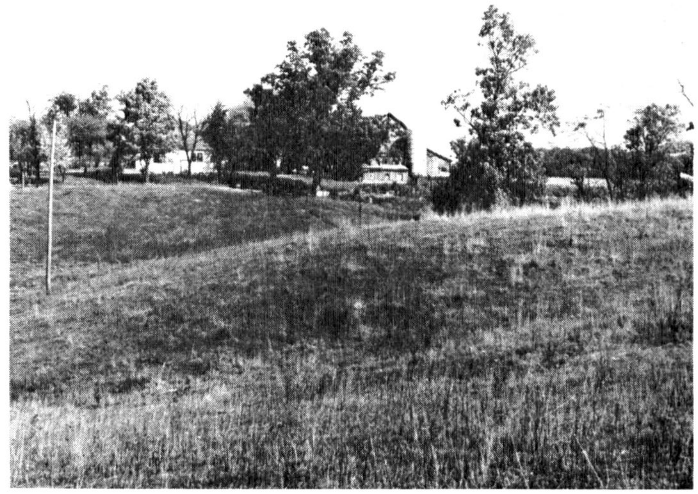

Figure 4.—Permanent pasture on breaks above the White River. Soil association 4.

Their underlying material is similar to that of the Mahalasville soils.

The soils in this association are planted to all crops commonly grown in the county, but artificial drainage is needed in most areas. Lime is needed on Sleeth soils, but not on the Mahalasville. Fertilizer should be added in amounts indicated by soil tests.

6. Fox-Eel association: Nearly level to strongly sloping soils on terraces and flood plains

Bottom lands and terraces along the major streams of the county make up this soil association. In a few depressions plant remains have accumulated. On the terraces are the Fox, Ockley, Sleeth, Westland, Kokomo, Homer, Camden, and Mahalasville soils. Eel, Genesee, Ross, Shoals, and Sloan soils are on the bottom lands. Also in this association are small areas of Rodman and Washtenaw soils. This association occupies about 63 square miles.

The Fox and Homer soils have a total area of about 29 square miles in this association. These soils are moderately deep, silty or loamy, and moderately dark colored or dark colored. They are 24 to 42 inches deep over limy sand and gravel (fig. 5).

Occupying 12 square miles are the Ockley, Sleeth, and Westland soils and the Kokomo soils that have a gravelly substratum. These soils are deep, silty, and moderately dark colored or dark colored. They are 42 to 70 inches deep over limy sand and gravel.

Covering a total area of 7 square miles in this association are the Camden soils, Mahalasville soils, and the Kokomo soils that do not have a gravelly substratum. These soils are deep, silty, and moderately dark colored or dark colored. They are 42 to 60 inches deep over limy silt and fine sand.

The well-drained Ockley, Fox, and Camden soils are on nearly level or gently sloping terraces. Fox soils are also on strongly sloping uplands, where they occur with small areas of Rodman soils on very steep slopes. Sand and gravel underlie the Rodman soils at a depth of less than 12 inches. Because sand and gravel are fairly near the

Figure 5.—**A gravel pit in the Fox and Ockley soils of soil association 6.**

surface in the Fox and Rodman soils, droughtiness is a problem. Erosion is likely on the gentle to strong slopes if they are cultivated. The more nearly level areas, however, are suited to all crops commonly grown in the county. The sloping and strongly sloping areas may be cropped occasionally if they are well managed. Rodman soils are less well suited to crops than to permanent vegetation, especially trees. Periodic applications of lime and fertilizer are needed on all of these soils if crop yields are to be favorable.

The somewhat poorly drained Sleeth and Homer soils occupy the nearly level areas. Tile drains or open ditches are needed to drain the excess water. If these soils are drained, they are well suited to all crops commonly grown in the county. Periodic additions of lime and fertilizer are needed if yields are to be favorable.

The Westland and Mahalasville soils occupy the nearly level and depressional areas and are very poorly drained and dark colored. The clay in the surface layer of these soils makes them difficult to plow, especially when they are wet. Tile drains and surface ditches are used to remove the excess water. Generally, these soils do not require lime, but additions of fertilizer are desirable. The Kokomo soils are similar to the Westland and Mahalasville soils but are generally in the more depressional areas and are darker colored.

The Genesee, Ross, Eel, Shoals, and Sloan soils have a total area of about 15 square miles. These soils are deep, silty or loamy, and moderately dark colored or dark colored. They consist of material that was recently deposited during floods. If these soils are managed well, all of them are suited to the crops commonly grown in the county. The well-drained Genesee soils occupy areas that are flooded periodically, but not for long periods. The Ross soils are also well drained, but they have a dark-colored surface layer. The Eel soils are moderately well drained, the Shoals soils are somewhat poorly drained, and the Sloan soils are very poorly drained. These soils on bottom lands do not need lime, but additions of a complete fertilizer insure high yields. Tile drains and surface ditches are needed on the Shoals and Sloan soils if they are cultivated. In wet years Eel soils also require artificial drainage.

The small areas of Washtenaw soils in this association are in potholes and along the edge of valleys where soil material has washed in from the surrounding slopes and has formed a layer 10 to 40 inches thick over a dark-colored soil. These soils are very poorly drained and need artificial drainage.

7. Carlisle-Edwards-Linwood association: Nearly level organic soils in depressions

Bogs in which plant remains have accumulated characterize this association. These bogs are similar to the few that occur in other associations, especially associations 3 and 6. This association occurs in a Y-shaped area on the eastern boundary of the county, and in a small area in the south-central part. The total area is about 2 square miles.

The major soils in this association are Carlisle, Edwards, and Linwood mucks, but Wallkill soils also occur in some places. The Wallkill soils consist of 10 to 40 inches of recent alluvium over mucky material. The Carlisle, Edwards, and Linwood soils are very poorly drained and very dark colored. The organic layer is more than 42 inches thick in the Carlisle soils and less than 42 inches thick in the Edwards and Linwood soils. Underlying the organic layer is gray limy marl in the Edwards soils and loamy calcareous mineral material in the Linwood soils.

Artificial drainage is needed if the soils in this association are to be used for crops (fig. 6). If these soils are drained, they can be used continuously for corn or another row crop (fig. 7). Yields are high. Fertilizer should be applied in amounts indicated by soil tests. The muck in these areas is mined and sold commercially as a topdressing for lawns and gardens and for use in nurseries (fig. 8).

Figure 6.—**Wet area in soil association 7 that requires artificial drainage before it can be cropped.**

Descriptions of the Soils

This section describes the soil series (groups of soils) and single soils (mapping units) of Madison County. The approximate acreage and proportionate extent of each mapping unit are given in table 1.

Figure 7.—Corn on Carlisle muck.

Figure 8.—Commercial mining of muck in soil association 7.

The procedure of this section is first to describe the soil series, and then the mapping units of that series. Thus, to get full information about any one mapping unit, it is necessary to read the description of that unit and also the description of the soil series to which it belongs. As mentioned in the section "How This Survey Was Made," not all mapping units are members of a soil series. Gravel pits and Made land are miscellaneous land types and do not belong to a soil series but, nevertheless, are listed in alphabetic order along with the soil series.

Following the name of each mapping unit, there is a symbol in parentheses. This symbol identifies the mapping unit on the detailed soil map. At the end of each soil description, symbols in parentheses identify the capability unit and woodland suitablity group in which the soil has been placed. The page on which each grouping is described can be found readily by referring to the "Guide to Mapping Units" at the back of the report.

Soil scientists, engineers, students, and others who want more detailed descriptions of soil series should turn to the section "Formation and Classification of Soils." Many terms used in the soil descriptions and other sections of the report are defined in the Glossary.

TABLE 1.—*Approximate acreage and proportionate extent of soils mapped*

Soil	Area	Extent	Soil	Area	Extent
	Acres	*Percent*		*Acres*	*Percent*
Blount silt loam, 0 to 2 percent slopes	21, 660	7. 5	Linwood muck	492	0. 2
Blount silt loam, 2 to 6 percent slopes, moderately eroded	1, 000	. 3	Made land	210	. 1
Brookston silt loam	1, 028	. 4	Mahalasville silt loam	400	. 1
Brookston silty clay loam	69, 758	24. 1	Mahalasville silty clay loam	9, 100	3. 1
Camden silt loam, 0 to 2 percent slopes	374	. 1	Mahalasville silty clay loam, limestone substratum	622	. 2
Camden silt loam, 2 to 6 percent slopes, moderately eroded	737	. 3	Miami silt loam, 0 to 2 percent slopes	3, 400	1. 2
Carlisle muck	632	. 2	Miami silt loam, 2 to 6 percent slopes, moderately eroded	12, 436	4. 3
Celina silt loam, 0 to 2 percent slopes	2, 085	. 7	Miami silt loam, 6 to 12 percent slopes, moderately eroded	1, 729	. 6
Celina silt loam, 2 to 6 percent slopes, moderately eroded	8, 369	2. 9	Miami silt loam, 12 to 18 percent slopes, moderately eroded	670	. 2
Clay pits	220	. 1	Miami silt loam, 18 to 25 percent slopes, moderately eroded	666	. 2
Crosby silt loam, 0 to 2 percent slopes	72, 934	25. 2	Miami soils, 2 to 6 percent slopes, severely eroded	1, 500	. 5
Crosby silt loam, 2 to 6 percent slopes, moderately eroded	2, 860	1. 0	Miami soils, 6 to 12 percent slopes, severely eroded	3, 444	1. 2
Edwards muck	195	. 1	Miami soils, 12 to 18 percent slopes, severely eroded	3, 500	1. 2
Eel silt loam	4, 264	1. 5	Miami soils, 18 to 25 percent slopes, severely eroded	450	. 2
Fox fine sandy loam, 0 to 2 percent slopes	100	(1)	Morley silt loam, 2 to 6 percent slopes, moderately eroded	3, 392	1. 2
Fox fine sandy loam, 2 to 6 percent slopes	98	(1)	Morley silt loam, 6 to 12 percent slopes, moderately eroded	739	. 3
Fox silt loam, 0 to 2 percent slopes	7, 986	2. 7	Morley silt loam, 12 to 18 percent slopes	76	(1)
Fox silt loam, 2 to 6 percent slopes, moderately eroded	4, 593	1. 6	Morley soils, 2 to 6 percent slopes, severely eroded	340	. 1
Fox silt loam, 6 to 12 percent slopes, moderately eroded	1, 090	. 4	Morley soils, 6 to 12 percent slopes, severely eroded	385	. 1
Fox silt loam, 12 to 18 percent slopes, moderately eroded	400	. 1	Morley soils, 12 to 18 percent slopes, severely eroded	184	. 1
Fox silt loam, limestone substratum, 0 to 2 percent slopes	120	(1)	Ockley silt loam, 0 to 2 percent slopes	720	. 2
Fox silt loam, till substratum, 0 to 2 percent slopes	3, 265	1. 1	Ockley silt loam, 2 to 6 percent slopes	927	. 3
Fox silt loam, till substratum, 2 to 6 percent slopes	1, 858	. 6	Pewamo silty clay loam	14, 400	5. 0
Fox silt loam, till substratum, 2 to 6 percent slopes, moderately eroded	1, 852	. 6	Rodman soils, 12 to 50 percent slopes, eroded	605	. 2
Fox silt loam, till substratum, 6 to 12 percent slopes	374	. 1	Ross loam	382	. 1
Fox silt loam, till substratum, 6 to 12 percent slopes, moderately eroded	576	. 2	Ross silt loam	465	. 2
Fox soils, 6 to 12 percent slopes, severely eroded	686	. 2	Shoals silt loam	467	. 2
Fox soils, till substratum, 2 to 6 percent slopes, severely eroded	410	. 1	Sleeth silt loam	492	. 2
Genesee silt loam	2, 832	1. 0	Sleeth silt loam, loamy substratum	372	. 1
Gravel pits	932	. 3	Sloan silt loam	275	. 1
Hennepin soils, 18 to 35 percent slopes, eroded	725	. 3	Wallkill complex	225	. 1
Homer silt loam	383	. 1	Washtenaw complex	2, 984	1. 0
Homer silt loam, limestone substratum	120	(1)	Westland silty clay loam	5, 210	1. 8
Kokomo silty clay loam	284	. 1	Westland silty clay loam, moderately deep	1, 978	. 7
Kokomo silty clay loam, stratified substratum	590	. 2	Water	432	. 1
Kokomo mucky silt loam, stratified substratum	530	. 2			
Kokomo silty clay loam, gravelly substratum	220	. 1	Total	289, 920	100. 0
Kokomo mucky silty clay loam, gravelly substratum	111	(1)			

[1] Less than 0.05 percent.

Blount Series

The Blount series consists of deep, light-colored to moderately dark colored, somewhat poorly drained soils of the uplands. These soils occupy nearly level to gently sloping areas in the northeastern corner of the county.

The surface layer is 7 to 10 inches of grayish-brown silt loam. The subsoil, about 17 inches thick, is mottled yellowish-brown and dark yellowish-brown silty clay loam to silty clay. Till, grayish-brown clay loam to silty clay loam, underlies the subsoil at a depth that is generally 26 inches but that ranges from 20 to 40 inches.

Blount soils have more clay in the subsoil and underlying till than Crosby soils and are generally shallower to calcareous till.

Blount soils are intermingled with the very poorly drained, dark-colored Pewamo soils in the depressions and with the moderately well drained and well drained, moderately dark colored Morley soils on slopes. Because these three kinds of soils are intricately mixed, they are difficult to manage separately, but some areas of Blount soils are large enough for separate management.

The plow layer of Blount soils is medium acid if it has not been limed. Crops on these soils respond well to addi-

tions of lime and a complete fertilizer. The available moisture capacity is moderately high, and general productivity is medium.

Blount silt loam, 0 to 2 percent slopes (BoA).—In areas mapped as this soil, small areas of moderately well drained Morley soils and dark-colored, very poorly drained Pewamo soils are included. This Blount soil has slow runoff and internal drainage. The water table is high in the spring, and tile drainage is needed to insure good yields. This soil is used intensively as cropland. (Capability unit IIw–2; woodland group 5)

Blount silt loam, 2 to 6 percent slopes, moderately eroded (BoB2).—This soil occurs on gently sloping knolls on the till plains and on divides near the head of drainageways. It is on slopes of more than 4 percent in only a few places. In about half of this soil the grayish-brown surface layer is 6 to 9 inches thick, and in the rest it is mixed with the yellowish-brown subsoil. Mottling occurs at a depth of 8 to 16 inches. The depth to limy till ranges from 24 to 36 inches. Included with this soil in mapping are a few severely eroded areas and, along narrow drainageways, small areas of Pewamo soils.

This productive Blount soil is used intensively for crops and is only moderately limited for that use. Although wetness is the major hazard, erosion is also a problem. (Capability unit IIw–2; woodland group 5)

Brookston Series

The Brookston series consists of deep, dark-colored, very poorly drained soils of the uplands. These soils occupy broad depressional flats, swales with many rounded projections, and narrow drainageways.

The surface layer is 8 to 15 inches of very dark gray silty clay loam. The subsoil is dark-gray silty clay loam to silty clay that is mottled with light yellowish brown. Till consisting of mottled yellow and brown loam to light clay loam underlies the subsoil.

The surface layer is dominantly silty clay loam but ranges to silt loam. Depth to limy till ranges from 42 to 60 inches.

Brookston soils have less clay in their subsoil and underlying till than the Pewamo soils. Underlying the Brookston soils is loam to clay loam till, but Westland soils are underlain by layers of limy sand and gravel, and the Mahalasville soils are underlain by layers of limy sand, silt, and small amounts of gravel and clay.

Brookston soils are intermingled with the somewhat poorly drained Crosby soils in nearly level areas, with the moderately well drained Celina soils on gentle slopes, with the well drained Miami soils on more rolling slopes, and with the very poorly drained Kokomo soils in lower depressions. All these soils are so intricately mixed in many places that managing them separately is difficult, but some areas of Brookston soils are large enough for separate management.

These soils are high in organic-matter content. Combinations of tile and surface drains are needed to remove excess water. Brookston soils have high available moisture capacity and are well suited to corn and other grain.

Brookston silty clay loam (0 to 2 percent slopes) (Bs).—Small areas of this soil have thin layers of silt, fine sand, clay, or gravel between the subsoil and the till. Instead of loam or clay loam, the till is silty clay loam in spots. In many areas bordering eroded sloping soils, 4 inches of silt loam overlies the silty clay loam that ordinarily is the surface layer. Included in areas mapped as this soil are spots that have a clay loam surface layer. Also included are small areas of light-colored, somewhat poorly drained Crosby soils and very dark colored, very poorly drained Kokomo soils.

This soil becomes hard, cloddy, and difficult to farm if it is plowed when it is too wet or is cropped too heavily. Wetness is the major hazard. Because this soil occupies depressions, tile or surface drains are needed to remove excess water. This soil has high available moisture capacity and is suited to corn and other grain. (Capability unit IIw–1; woodland group 11)

Brookston silt loam (0 to 2 percent slopes) (Br).—This soil has less clay in the surface layer than Brookston silty clay loam and, therefore, is easier to cultivate. Drainage needs and productivity are about the same as for Brookston silty clay loam. (Capability unit IIw–1; woodland group 11)

Camden Series

The Camden series consists of deep, moderately dark colored, well-drained soils on terraces. These soils occupy nearly level to sloping areas of the outwash plains or along the valleys of the major streams.

The dark grayish-brown silt loam surface layer is about 12 inches thick. The subsoil, about 44 inches thick, is brown silty clay loam or clay loam. Dark yellowish-brown layers of neutral or limy sand and silt underlie the subsoil at a depth that is generally about 44 inches but that ranges from 42 to 60 inches or more.

Instead of the layers of neutral or limy sand and silt that underlie the Camden soils, Ockley soils are underlain by limy layers of sand and gravel at a depth of 42 to 70 inches. In Fox soils, limy sand and gravel are at a depth of 24 to 42 inches.

Camden soils occur with the somewhat poorly drained Sleeth soils in flats or on slight rises, with the very poorly drained, dark colored Mahalasville soils, and with the very poorly drained, very dark colored Kokomo soils in the depressional flats.

Camden soils have medium to high available moisture capacity. The plow layer is medium acid to strongly acid if it has not been limed. Crops on these soils respond well to applications of nitrogen and other fertilizer. In most areas these soils are slightly to moderately susceptible to erosion. Water moves through the subsoil at a moderate rate.

Camden silt loam, 0 to 2 percent slopes (CaA).—This soil occurs in the broad level areas above the steep breaks along the larger streams of the county. In the southern half of the county, loam or light clay loam till occurs below the stratified sand and silt at a depth of about 55 to 60 inches.

This nearly level soil is productive and is not seriously limited in its use for crops. It has high available moisture capacity. Most of its acreage is cropland that can be cultivated intensively. (Capability unit I–1; woodland group 1)

Camden silt loam, 2 to 6 percent slopes, moderately eroded (CaB2).—In about half the acreage of this soil, the plow layer contains some brown silty clay loam subsoil material and is more sticky when wet and less friable when moist than the plow layer of the soil described for the

series. In some spots included in the mapping, coarse sand underlies the subsoil. Also included are areas having limy till below the layers of limy silt and sand and small areas of Camden silt loam, 0 to 2 percent slopes.

Erosion is the major problem on this productive soil. It may be overcome by using contour cultivation and a suitable cropping system. Runoff and available moisture capacity are medium. (Capability unit IIe-1; woodland group 1)

Carlisle Series

The Carlisle series consists of a deep, very dark colored, very poorly drained muck. This muck occupies long low areas in abandoned glacial channels and the lowest depressions in areas of very poorly drained soils on uplands. Areas of this muck were shallow ponds or bogs in which the remains of plants accumulated.

The black organic layer extends from the surface to a depth of 42 inches or more. It is uniform in color and texture except where there are layers of dark-brown, coarser textured peat.

In Carlisle soils organic material extends to a depth of more than 42 inches, but in Linwood soils the muck extends only to 42 inches or less. In Edwards soils very limy marl underlies the organic layer at a depth of 12 to 42 inches. In some places Carlisle soils occur with the Wallkill soils, which have 10 inches or more of mineral soil over the organic material. In a few places Carlisle soils occur closely with the Edwards soils, Linwood soils, or both and generally are farmed with them.

Carlisle soils are very high in organic-matter content but have poor natural drainage. They have high available moisture capacity, and can produce favorable yields of corn. These soils are susceptible to wind erosion when they are dry.

Carlisle muck (0 to 2 percent slopes) (Cm).—Included in mapped areas are small areas having less than 42 inches of muck over clay, silt, sand, or marl. Thin layers of mineral soil may occur within the muck. In many places the top of the surface layer is silty material washed from adjacent mineral soils.

Since this soil is very poorly drained, crops cannot be successfully grown without a good system of drainage. Drainage outlets are hard to find. Surface drains work well on this soil, and tile also may be used if precautions are taken to keep the soil from settling. This soil is well suited to field corn and to sweet corn, mint, onions, carrots, celery, potatoes, and other special crops. Areas that are difficult to drain are generally in permanent pasture of bluegrass. (Capability unit IIIw-8; woodland group 23)

Celina Series

The Celina series consists of deep, moderately well drained soils that are light colored to moderately dark colored. These soils occupy nearly level to gentle slopes of the uplands.

The surface layer, to a depth of 9 to 11 inches, is grayish-brown, friable silt loam. The subsoil extends to an average depth of 27 inches. It is brown silty clay loam or clay loam in the upper part and is darker and mottled with shades of yellowish brown in the lower part. The underlying material consists of mottled brownish-yellow calcareous till of loam to light clay loam texture.

The depth to calcareous till ranges from about 24 inches in sloping areas to about 42 inches in more nearly level areas.

The Celina soils have less clay in the subsoil than Morley soils and are underlain by coarser textured till.

Celina soils occur with the well-drained Miami soils, with the somewhat poorly drained Crosby soils, with the very poorly drained Brookston soils, and with the very dark colored, very poorly drained Kokomo soils.

These productive soils have medium available moisture capacity. Additions of organic matter, fertilizer, and lime are beneficial if these soils are cropped.

Celina silt loam, 0 to 2 percent slopes (CnA).—This soil occurs in small patches scattered throughout larger areas of other Celina soils. Normally it is on the till plains bordering or near streams.

This nearly level soil is moderately productive and is not seriously limited in its use for crops. The available moisture capacity is medium. Most of the acreage is cropland that can be farmed intensively. (Capability unit I-1; woodland group 1)

Celina silt loam, 2 to 6 percent slopes, moderately eroded (CnB2).—This soil occurs along drainageways and on low knolls in areas of nearly level and depressional soils. In some places erosion has been slight, but in most places the plow layer is a mixture of part of the yellowish-brown subsoil and the original grayish-brown surface layer. Included in mapped areas are small areas of well-drained Miami soils and somewhat poorly drained Crosby soils.

This soil is productive and is only moderately limited in its use for crops. Erosion is the major hazard. Although this soil is generally within fields of more nearly level soils and is farmed with those soils, it should receive special attention so that production is maintained and erosion is controlled. Among the practices that reduce runoff and erosion are adding manure, managing crop residues, using suitable cropping systems, and establishing sod waterways. (Capability unit IIe-1; woodland group 1)

Clay Pits

Clay pits (Cp) are abandoned depressional areas that have been stripped of their surface layer and most of their subsoil. The floor of these depressions is mostly limy clay loam or silty clay loam till. Approximately 200 acres occur east of Summitville near sites of old clay-using industries, but a few small areas are in other parts of the county. Small intermittent ponds occur in some of the larger areas. Clay pits, which include small islands of Blount soils, are used for permanent pasture. (Capability unit not assigned; woodland group 23)

Crosby Series

The Crosby series consists of light-colored to moderately dark colored, deep, somewhat poorly drained soils. These soils occur in nearly level to slightly undulating areas of the uplands.

The surface layer, about 10 inches thick, is grayish-brown, smooth, friable silt loam. The subsoil is firm, compact, light brownish-gray clay loam or silty clay loam that is highly mottled with yellowish brown and gray. Mottled, highly calcareous loam till underlies the subsoil. In

some places a few inches of sand or gravel is above the calcareous till. The depth to calcareous till ranges from less than 24 inches on gentle slopes to 42 inches or more in flat areas.

Crosby soils have a coarser textured subsoil than the Blount soils and parent material of loam to light clay loam, instead of clay loam to heavy silty clay loam.

Crosby soils, which occur mostly in nearly level areas, generally occur with the very poorly drained Brookston or Kokomo soils, with the moderately well drained Celina, and with the well drained Miami soils. The Celina and Miami soils normally occur together in gently sloping to sloping areas.

Crosby soils are low in organic-matter content. The plow layer is medium acid unless it has been limed. Crops on these soils respond well to additions of lime and a complete fertilizer. The water table is high in spring, and tile is needed to insure good crop yields. These soils have high to medium available moisture capacity and slow permeability.

Crosby silt loam, 0 to 2 percent slopes (CrA).—This soil occurs on nearly level slopes or at the head of small drainageways. Included in some mapped areas are small areas of moderately well drained Celina soils and of very dark gray, very poorly drained Brookston and Kokomo soils in depressions.

Wetness is the major limitation, but this soil is productive if adequate drainage is established. It has high available moisture capacity. Runoff is slow and there is little erosion. Use for crops is intensive. (Capability unit IIw–2; woodland group 5)

Crosby silt loam, 2 to 6 percent slopes, moderately eroded (CrB2).—This soils occurs on rises within areas of the depressional, dark-colored, very poorly drained Brookston and Kokomo soils. In some places on gentle slopes, it occurs with moderately well drained Celina soils. On about one-third of the acreage, erosion has been slight, but the rest of this soil is moderately eroded and has a plow layer consisting of the original surface soil mixed with a moderate amount of brownish subsoil. Included in some mapped areas are small areas of moderately well drained Celina soils.

This soil is productive and is only moderately limited in its use for crops. The available moisture capacity is medium. Although wetness is the major hazard, erosion is also important. Since this soil is cultivated intensively, practices are needed to control erosion. Among these practices are adding manure, using crop residues, and establishing grassed waterways, especially in the more sloping areas. (Capability unit IIw–2; woodland group 5)

Edwards Series

The Edwards series consists of moderately deep, very dark colored, very poorly drained organic soils. These soils are mucks that occupy low areas along Prairie Creek and other small streams. They were once the sites of shallow ponds in which the remains of plants have accumulated.

The black, organic surface layer is 12 to 42 inches thick over marl, a material high in lime. The organic material is generally uniform in color and texture, but in some places thin layers of peat occur between the muck and the marl.

The thickness of the organic material in Edwards soils is not more than 42 inches, which is less than that of the organic material in the Carlisle soils. The muck in the Edwards soils is underlain by marl, but in the Linwood soils it is underlain by loam, silt loam, or silt at a depth of 12 to 42 inches. In many places Edwards soils are next to Carlisle or Linwood soils, or both, and are normally farmed with them.

Edwards soils are very high in organic-matter content. Because they are generally in low places, they have a high water table and slow to ponded runoff. The available moisture capacity is high. If these soils are adequately drained and properly fertilized, they produce favorable yields of corn. Wind erosion is likely when these soils are dry.

Edwards muck (0 to 2 percent slopes) (Ed).—This soil has the characteristics described for the Edwards series. Included with this soil in mapping are small areas where the organic material is thicker than 42 inches. Also, in some small areas the organic material is underlain by clay, sand, and silt instead of by marl.

A good drainage system is needed if crops are grown on this very poorly drained soil. Drainage outlets, however, are hard to find. Because tile is suitable only in a system of controlled drainage, open ditches are best on this soil. Drained areas are well suited to field corn and to sweet corn, onions, carrots, and other special crops. Areas that are difficult to drain are generally in permanent pasture. (Capability unit IVw–3; woodland group 23)

Eel Series

The Eel series consists of deep, moderately dark colored, moderately well drained soils on bottom lands along most of the streams in the county.

The surface layer is 8 to 10 inches of dark-brown to very dark grayish-brown silt loam. It is underlain by 12 to 18 inches of dark-brown silt loam that is underlain, in turn, by mottled grayish-brown and yellowish-brown silt loam.

These soils have had little development other than the accumulation of organic matter in their surface layer. The surface layer is neutral to alkaline. The depth to mottling ranges from 18 to 30 inches. In some places thin layers of sand occur in these soils.

The Eel soils occur with the somewhat poorly drained Shoals soils, with the well-drained Genesee soils, and with the very poorly drained Sloan soils.

Eel soils have high to very high available moisture capacity. Runoff is slow to ponded, and internal drainage is medium. These soils are productive if the crops are not damaged by floods. If streambanks are not protected, the soils erode slightly. Lime is not needed.

Eel silt loam (0 to 2 percent slopes) (Es).—This soil is subject to frequent flooding, principally from December to June. Some narrow stream-dissected areas are suited only to pasture or trees. In some areas limy gravel occurs at a depth of 24 to 42 inches. Included in mapped areas are small pockets of more poorly drained soils.

Because flooding is likely from December to June, the cropping systems should not include fall-seeded grain and hay. Corn and soybeans are the principal crops. They can be planted in summer and harvested early in fall when flooding is less likely. In some areas tile drains are

needed to lower the water table during the wet years. This soil responds moderately well to good management. (Capability unit IIw–7; woodland group 8)

Fox Series

The Fox series consists of light-colored to moderately dark colored, moderately deep, well-drained soils that are underlain by stratified sand and gravel or by limy till. These soils are normally on low terraces bordering the bottom lands or are on higher gently sloping or sloping terraces. They occur also as knolls or hills of the uplands. These soils occur along the White River and along Pipe, Kilbuck, and Fall Creeks. Some nearly level areas are south of Pendleton and Chesterfield.

The brown silt loam surface layer is 9 to 12 inches thick. The subsoil is brown or yellowish-brown clay loam about 24 inches thick. Very waxy, reddish-brown material makes up the lower part of the subsoil. This material is underlain by stratified limy sand and gravel at a depth that is generally 36 inches but that ranges from 24 to 42 inches or more.

In depth to calcareous sand and gravel, the Fox soils range from about 38 inches in the level areas to almost 24 inches in the sloping areas. Tongues of the reddish-brown subsoil extend into the limy sand and gravel. Small areas of loam, sandy loam, or gravelly loam occur in some places, especially along the major streams. In places where the Fox soils are underlain by limy till at a depth of 18 to 42 inches, these soils are mapped as the till substratum phase.

Fox soils are less silty in the subsoil than Ockley soils, which are underlain by calcareous sand and gravel at a depth of 42 inches or more.

Fox soils occur with the poorly drained, dark-colored Westland soils in the depressional areas and with the somewhat poorly drained, light-colored to moderately dark colored Homer soils in the nearly level to gently sloping areas. Fox soils also occur with the somewhat poorly drained Sleeth soils and with the poorly drained, dark-colored Westland soils. In the Westland soils, gravel and sand are at a depth of more than 42 inches.

The Fox soils are productive, but during dry periods corn and similar crops are affected by a lack of moisture. Crops respond well to applications of nitrogen and other fertilizer. If these soils are not limed, their plow layer is medium acid.

Fox silt loam, 0 to 2 percent slopes (FoA).—This soil occurs on the nearly level terraces. Its surface layer is 9 to 12 inches thick.

This productive soil has medium available moisture capacity. Runoff is slow, and the susceptibility to erosion is slight. Corn and similar crops are affected by a lack of water during dry periods. Crops produce good yields if they are grown in a suitable cropping system. Droughtiness, the major limitation, may be overcome by irrigation, or may be partly overcome by the use of cover crops, green manure, and deep-rooted legumes. (Capability unit IIs–1; woodland group 1)

Fox silt loam, 2 to 6 percent slopes, moderately eroded (FoB2).—This soil occurs on gently sloping terraces, on short slopes around drainageways, and on gravel knolls and ridges of the uplands. On about half of the acreage, erosion has been slight. The other half is moderately eroded and has a plow layer consisting of the original surface soil mixed with a moderate amount of the brownish subsoil. Included in mapped areas are small severely eroded areas in which the plow layer is largely material that was subsoil.

This soil is easy to plow, except in spots where the dark-brown subsoil is exposed. Erosion is the major hazard, but droughtiness is also a limitation. Crop yields are slightly lower than on Fox silt loam, 0 to 2 percent slopes, and good practices of management are needed. (Capability unit IIe–9; woodland group 1)

Fox silt loam, 6 to 12 percent slopes, moderately eroded (FoC2).—This soil occurs on the breaks of terraces around the head of drainageways and on the sides of gravelly knolls and ridges of the uplands. On about 20 percent of the acreage, erosion has been slight. The rest is moderately eroded and has a surface soil consisting of the original surface soil mixed with a moderate amount of the brownish subsoil. The dark-reddish lower subsoil is exposed, or loose gravel may be plowed up in many small areas. Runoff is rapid, and the susceptibility to erosion is moderate to severe. The available moisture capacity is low.

This soil is used for crops, but yields are moderate to low. Good practices of management are needed to prevent further loss of soil. Erosion is the major hazard. (Capability unit IIIe–9; woodland group 1)

Fox silt loam, 12 to 18 percent slopes, moderately eroded (FoD2).—This soil occurs on the breaks in the high terraces and on steep slopes. It also occupies the steeper parts of gravelly knolls and ridges of the uplands. The surface layer consists of the original surface soil mixed with a moderate amount of the brownish subsoil. In small areas the reddish-brown lower subsoil is exposed or the loose limy sand and gravel is on the surface. Runoff is rapid, and the risk of erosion is severe. The available moisture capacity is low.

This soil is best suited to cropping systems that last a long time, or to permanent pasture. Small areas, however, are cultivated the same way as surrounding larger areas that are more suitable for row crops. In cultivated areas, yields are low and the erosion hazard is greatest. (Capability unit IVe–9; woodland group 1)

Fox soils, 6 to 12 percent slopes, severely eroded (FtC3).—These soils occupy short breaks in terraces or narrow strips around the head of drainageways. They are also on the sloping sides of gravelly ridges and knolls of the uplands. The surface layer consists of brown to brownish-red clay loam that was formerly subsoil. In a few spots loose calcareous sand and gravel are exposed. Runoff is rapid, erosion is severe, and the available moisture capacity is low.

This soil has been cultivated, but it is better suited to permanent pasture than to crops. Small areas, however, are farmed the same way as surrounding areas of less sloping, more productive soils. Practices of erosion control are needed to prevent further loss of soil. (Capability unit IVe–9; woodland group 1)

Fox fine sandy loam, 0 to 2 percent slopes (FoA).—This soil occurs on the nearly level terraces. It is similar to Fox silt loam, 0 to 2 percent slopes, except for texture of the surface layer. The surface layer is 9 to 12 inches thick. This soil is fertile, but available moisture capacity is low.

This soil is used for about the same kinds of crops as is Fox silt loam, 0 to 2 percent slopes, but has lower yields because the supply of moisture is small. Droughtiness, the major limitation, may be partly overcome by the use of cover crops, green manure, and deep-rooted legumes. (Capability unit IIs-1; woodland group 2)

Fox fine sandy loam, 2 to 6 percent slopes (FaB).—This soil is similar to Fox silt loam, 2 to 6 percent slopes, moderately eroded, except for the texture of the surface layer. Like that soil, it is used for crops, but its general productivity is medium and its available moisture capacity is medium to low. Erosion is the major hazard, but droughtiness is also a problem. The use of an appropriate cropping system helps reduce erosion. (Capability unit IIIe-9; woodland group 2)

Fox silt loam, limestone substratum, 0 to 2 percent slopes (FrA).—This soil occurs on nearly level terraces near channels and streams. The silt loam plow layer is 9 to 12 inches thick, and depth to limestone is 18 to 42 inches. Included with this soil are small areas that have slopes of more than 2 percent and small spots that are somewhat poorly drained.

This productive soil has medium available moisture capacity. Crops are affected by the lack of water during prolonged dry periods. Droughtiness is the major limitation. This soil is used for crops that produce good yields if they are grown in a suitable cropping system. The best suited crops are fall-seeded small grain, deep-rooted legumes, and other meadow crops. (Capability unit IIs-4; woodland group 1)

Fox silt loam, till substratum, 0 to 2 percent slopes (FsA).—This soil occurs in broad, nearly level areas back of the steep breaks along the larger streams of the county. A few glacial pebbles are on the surface. Included in mapped areas are a few small areas that have more than 6 inches of gravel and sand between the subsoil and the till. Also included are small moderately eroded knobs. The depth to till is more than 42 inches in some areas.

This productive soil is not seriously limited in its use for crops. Available moisture capacity and general productivity are medium to high. Runoff is slow, and susceptibility to erosion is slight. This soil is used mostly as cropland, and it can be cultivated intensively. (Capability unit I-1; woodland group 1)

Fox silt loam, till substratum, 2 to 6 percent slopes (FsB).—This soil occurs on low ridges or divides between the uplands and terraces. It has a dark yellowish-brown surface layer that ranges from 8 to 10 inches in thickness and a dark reddish-brown subsoil that ranges from 16 to 30 inches. Included in mapped areas are moderately eroded areas with slopes of more than 6 percent that are too small to map separately. Also included are small areas in which the till is at a depth of more than 42 inches.

This productive soil has slow to medium runoff. The hazard of further erosion may be overcome by using contour cultivation and a suitable cropping system. (Capability unit IIe-1; woodland group 1)

Fox silt loam, till substratum, 2 to 6 percent slopes, moderately eroded (FsB2).—This soil occurs on gentle slopes along glacial channels. The surface layer consists of the original dark yellowish-brown surface soil mixed with a moderate amount of dark reddish-brown subsoil. The depth to limy till is generally less than in slightly eroded Fox soils. Included in mapped areas are small knolls of severely eroded Fox soils in which a large part of the surface soil is material that was subsoil.

This productive soil has medium runoff. The moderate hazard of erosion may be overcome by using contour cultivation and a suitable cropping system. (Capability unit IIe-1; woodland group 1)

Fox silt loam, till substratum, 6 to 12 percent slopes (FsC).—This soil occurs on the breaks along Fall Creek, Pipe Creek, Kilbuck Creek, and the White River. It has a dark yellowish-brown surface layer 7 to 9 inches thick. The depth to limy till is 24 to 36 inches. Included in mapped areas are some small areas that have slopes of more than 12 percent.

This soil is suited to the crops commonly grown in the county, but runoff is rapid, the hazard of erosion is moderate, and available moisture capacity is medium. Appropriate practices are needed to conserve soil and water if this soil is plowed and planted to row crops. (Capability unit IIIe-1; woodland group 1)

Fox silt loam, till substratum, 6 to 12 percent slopes, moderately eroded (FsC2).—This soil occurs along Fall Creek, Pipe Creek, Kilbuck Creek, and the White River. The plow layer consists of the dark yellowish-brown surface soil mixed with the reddish-brown subsoil. Pebbles are numerous on the surface, and larger stones occur in many places. Depth to limy till is less than in Fox silt loam, till substratum, 6 to 12 percent slopes. Included in mapped areas are a few small areas that have slopes of more than 12 percent.

This soil is suited to the crops commonly grown in the county, but runoff is rapid, further erosion is likely, and available moisture capacity is only medium. The use of appropriate practices to conserve soil and water are needed if this soil is cultivated. (Capability unit IIIe-1; woodland group 1)

Fox soils, till substratum, 2 to 6 percent slopes, severely eroded (FxB3).—This soil occurs on gentle slopes along glacial channels. Most of the surface layer has been lost through erosion. The plow layer consists largely of dark reddish-brown subsoil that is difficult to plow and becomes cloddy when it dries. Glacial pebbles are numerous on the surface, and larger stones are plowed up in many places. Included in mapped areas are small areas of moderately eroded Fox soils and very poorly drained Brookston soils.

This moderately productive soil is severely limited in its use for crops. Runoff is rapid, erosion is the major hazard, and available moisture capacity is low. Although this soil is farmed with less eroded soils in many places, it should receive special attention if erosion is to be controlled and production maintained. (Capability unit IIIe-1; woodland group 1)

Genesee Series

The Genesee series consists of deep, moderately dark colored, well-drained soils on bottom lands along the major streams of the county.

The surface layer is generally 8 inches of dark-brown silt loam. It is underlain by brown silt loam.

The surface layer ranges from very dark gray to dark yellowish brown and is neutral to calcareous. The content of sand throughout the profile varies considerably and is

generally higher near the streams, especially the larger ones.

Genesee soils have a thinner and lighter colored surface layer than Ross soils.

The Genesee soils occur on the stream bottoms with the moderately well drained Eel soils, with the somewhat poorly drained Shoals soils, and with the very poorly drained Sloan soils.

Genesee soils have high to very high available moisture capacity, slow runoff, and medium internal drainage. These soils are productive if the crops are not damaged by floods. Streambanks erode slightly if they are not protected.

Genesee silt loam (0 to 2 percent slopes) (Gn).—This soil occurs on narrow, dissected bottom lands along creeks. Included on streambanks in areas mapped as this soil are small areas that have a fine sandy loam or loam surface layer. Also included are small areas of moderately well drained and somewhat poorly drained soils.

Because flooding is likely, especially from December to June, the cropping system should not include a fall-seeded grain or a legume, unless this soil is protected by levees. If management is good, cropping can be heavy without danger of damage. This soil is easy to work. Corn and soybeans are the principal crops. Trees have been left along some of the larger streams where the soil is sandier than normal. (Capability unit I–2; woodland group 8)

Gravel Pits

Gravel pits (Gr) occur in areas of Fox, Ockley, Westland, Homer, Sleeth, and other soils that are underlain by loose sand and gravel. These pits are excellent sources of gravel that is used for road construction. Most of these pits occur in the southern half of the county along Kilbuck Creek, Pipe Creek, Fall Creek, and the White River. Some dry pits are in the Anderson esker and in small kames scattered throughout the uplands. Pits that are permanently filled with water are used as fishponds and for recreational areas. (Capability unit not assigned; woodland group 23)

Hennepin Series

The Hennepin series consists of moderately dark colored, deep, well-drained soils that are underlain by calcareous till. These soil are steep and occur in the uplands along the major streams in the county.

The surface layer generally is 4 to 6 inches of very dark grayish-brown to dark yellowish-brown silt loam. It is underlain by dark-brown to dark yellowish-brown limy till at a depth of 4 to 12 inches.

The surface layer ranges from very dark grayish brown to dark yellowish brown. In many places these soils contain a thin light silty clay loam subsoil. In some places there is a thin layer of light silty clay loam in the subsoil. The underlying till ranges from loam to light clay loam.

Hennepin soils occur with the Miami and Fox soils, and compared with them, have a thinner surface layer and are shallower to limy till.

Because Hennepin soils are steep, surface runoff is very rapid and available moisture capacity is medium. Natural drainage is excessive, and permeability is moderate. The general productivity for crops is low.

Hennepin soils, 18 to 35 percent slopes, eroded (HeF2).—Most of the acreage of these soils occurs on steep breaks along the major streams and has a cover of trees or shrubs. Large boulders are common on the surface. In places, particularly on the less steep slopes, these soils resemble the Miami and Fox soils and have a solum 1 to 2 feet thick and a medium acid subsoil. Included in mapped areas are small severely eroded areas that are gullied and small areas that have slopes of more than 35 percent.

These soils are best suited to pasture or trees. Erosion is the major hazard. (Capability unit VIIe–2; woodland group 2)

Homer Series

The Homer series consists of light-colored to moderately dark colored, moderately deep, somewhat poorly drained soils. These soils occur on nearly level terraces in the valleys of Fall Creek, Pipe Creek, and the White River.

The surface layer generally consists of 7 to 10 inches of dark grayish-brown silt loam. The subsoil is mottled grayish-brown and yellowish-brown silty clay loam to gravelly clay loam. Layers of grayish-brown and yellowish-brown limy sand and gravel underlie the subsoil at a depth of 36 inches in most places.

The surface layer ranges from dark grayish brown to light grayish brown and is as much as 14 inches thick in some places. In some places limestone bedrock is at a depth of less than 18 to 42 inches, and in these a limestone substratum phase is mapped.

Sand and gravel generally underlie the Homer soils at a depth of less than 42 inches but underlie the Sleeth soils at a depth of 42 to about 70 inches.

Homer soils occur with the well-drained Fox soils and with the very poorly drained Westland soils. They are slightly lower than the Fox soils and are higher than the Westland soils, which are in depressional flats.

The plow layer of Homer soils is medium acid unless it has been limed. Internal drainage and runoff are slow. Available moisture capacity and general productivity are medium.

Homer silt loam (0 to 2 percent slopes) (Hm).—In many places this soil occurs in low swales and has a surface layer 10 to 14 inches thick. Included in mapped areas are moderately eroded soils on small knolls and small areas of gently sloping soils. Also included are small areas of dark-colored, very poorly drained Westland soils in depressions.

This soil is well suited to corn and other crops. Wetness is the major hazard. In spring the water table is generally high, and artificial drainage is needed. Open ditches are more satisfactory than tile for lowering the water table, but tile may be used to supplement the ditches if controlled drainage is practical. (Capability unit IIw–6; woodland group 5)

Homer silt loam, limestone substratum (Hn).—Limestone underlies this soil at a depth of 18 to 42 inches, and pieces of limestone, several inches across, are in the subsoil in some areas. Included in nearly level and gently sloping areas are small areas of well-drained Miami soils.

Artificial drainage is needed if production is to be optimum, for wetness is the major hazard. Tile is suitable only where the limestone is uniformly at a depth of

more than 36 inches. (Capability unit IIIw-7; woodland group 5)

Kokomo Series

The Kokomo series consists of deep, very dark colored, very poorly drained soils that occur in low swales of the uplands.

The surface layer is 18 to 24 inches of black or very dark brown silty clay loam. The subsoil is gray silty clay loam mottled with yellowish brown. Mottled gray and yellowish-brown till of loam to coarse clay loam texture generally underlies the subsoil at a depth of 42 to 70 inches. In some places these soils are underlain by gravel, and a gravelly phase is mapped. In other places the underlying material is stratified, and a stratified substratum phase is mapped.

The Kokomo soils generally occur in the deeper part of depressions within larger areas of Brookston soils and, if adequately drained, are farmed with the Brookston soils. Kokomo soils also occur with the somewhat poorly drained Crosby soils in nearly level areas, with the moderately well drained Celina soils in gently sloping areas, and with the well drained Miami soils in the more rolling areas.

Kokomo soils are high in organic-matter content, and they do not need additions of lime. They have high available moisture capacity and very slow internal drainage. Runoff is very slow or ponded.

Kokomo silty clay loam (0 to 2 percent slopes) (Kc).—Small areas of this soil have thin layers of silt, sand, or gravel between the subsoil and the till. Included in areas mapped as this soil are areas that have as much as 6 inches of muck on the surface and areas that have a silt surface layer. Areas of this soil that border severely eroded slopes are lighter colored than other areas and have a coarser textured surface layer because material from the severely eroded slopes has washed in.

This soil becomes hard, cloddy, and difficult to farm if it is plowed when it is wet or is cropped too heavily. Wetness is the major hazard. Combinations of tile and surface drains are needed if this soil is to be brought into production, but drainage may be difficult because there is not enough fall between the level of this soil and the level of the outlets. (Capability unit IIw-1; woodland group 11)

Kokomo silty clay loam, gravelly substratum (0 to 2 percent slopes) (Kg).—This soil is somewhat similar to the soil described for the series, but several kinds of inclusions occur in areas mapped. Areas that border severely eroded slopes are lighter colored and coarser textured than other areas because material from the severely eroded slopes has washed in. The coarser texture makes those areas easier to plow. In areas bordering areas of muck, the organic-matter content is higher than normal. Small areas of muck are included in areas mapped as this soil.

Wetness is the major hazard, but crop production is successful if this soil is artificially drained. Tile is generally effective in removing the excess water. (Capability unit IIw-1; woodland group 11)

Kokomo mucky silty clay loam, gravelly substratum (0 to 2 percent slopes) (Kt).—This soil is similar to Kokomo silty clay loam, gravelly substratum, but it has as much as 12 inches of muck on the surface. (Capability unit IIw-1; woodland group 11)

Kokomo silty clay loam, stratified substratum (0 to 2 percent slopes) (Km).—This soil is similar to the soil described for the series except that the underlying material is stratified. Included in mapped areas are small areas that have a dark surface layer less than 18 inches thick.

Wetness is the major hazard, and tile drains are needed to lower the water table. The use of this soil for crops is intensive. (Capability unit IIw-1; woodland group 11)

Kokomo mucky silt loam, stratified substratum (0 to 2 percent slopes) (Ks).—This soil occurs along Prairie Creek south of Anderson. Its surface layer consists of 5 to 10 inches of muck and is underlain by a silty subsoil. The substratum is stratified. Limy silt occurs at a depth of less than 42 inches in most places.

This soil is well suited to truck crops and to corn. Wetness is the major hazard. (Capability unit IIw-1; woodland group 11)

Linwood Series

The Linwood series consists of moderately deep, very dark colored, very poorly drained areas of muck. These areas occupy long stretches of old glacial valleys. They were formerly bogs in which the remains of plants accumulated.

The black organic layer extends from the surface to a depth of 12 to 42 inches and is underlain by loam, silt loam, or silt. This layer is uniform in color and texture except where thin layers of peat occur.

In Linwood soils the organic surface layer ranges from 12 to 42 inches in thickness, but in the Carlisle soils this layer is thicker than 42 inches in some places. The organic layer of Linwood soils is underlain by loam, silt loam, and silt, but the organic layer of Edwards soils is underlain by limy marl at a depth of 12 to 42 inches. In some places Linwood soils occur with the Wallkill soils, which have 10 or more inches of mineral soil over an organic layer. In some places Linwood soils occur next to the Carlisle, Edwards, or Wallkill soils and are farmed with them.

Linwood soils have very high organic-matter content, very poor natural drainage, and high available moisture capacity. Favorable yields of corn can be produced. These soils are susceptible to wind erosion when they are dry.

Linwood muck (0 to 2 percent slopes) (Lm).—This soil is similar to the soil described for the series. Included in mapped areas are small areas in which the organic layer is underlain by clay and sand rather than by loam, silt loam, or silt. Also included are pockets in which the organic material is deeper than 42 inches. In some places the surface layer contains silty material that washed from eroded slopes.

Because this soil is very poorly drained, crops cannot be grown successfully unless a good system of drainage is installed. Outlets for drainage are hard to find. The water table can be lowered by open ditches that are supplemented by tile. Unless the height of the water table is controlled, this soil dries and settles. This soil is well suited to field corn and to sweet corn, onions, carrots, and other special crops. Areas that are difficult to drain are generally in permanent pasture of bluegrass. (Capability unit IIw-10; woodland group 23)

Made Land

Made land (Ma) consists of bottom land, borrow pits, gravel pits, and other depressions that have been filled

with refuse and then thinly covered with soil material. The land is so altered by industrial and building activities that it cannot be called soil. Most of it occurs near urban areas. Plants of little or no value grow in some places. Although practices to control erosion are needed in many places, these practices vary as the land varies and general suggestions about management cannot be made. (Capability unit not assigned; woodland group 23)

Mahalasville Series

The Mahalasville series consists of deep, dark-colored, very poorly drained soils on terraces. These soils occur in old glacial channels and on broad depressional flats of the glacial outwash plain in the northwestern corner of the county.

The surface layer is 9 to 16 inches of very dark gray silty clay loam. The subsoil, about 32 inches thick, is gray silty clay, silty clay loam, or clay loam mottled with brown and reddish brown. The subsoil is underlain by light-gray layers consisting of limy fine sand, silt, and small amounts of gravel and clay. Depth to these layers generally is at 44 inches, but it ranges from 42 to 60 inches or more. In some areas Mahalasville soils are underlain by limestone bedrock at a depth of 18 to 42 inches, and these areas are mapped as the limestone substratum phase.

The surface layer ranges from very dark gray to black. It is dominantly silty clay loam, but it ranges to silt loam in some places.

Mahalasville soils are underlain by sand and silt at a depth of 42 to 60 inches, but Westland soils are underlain by sand and gravel at a depth of 42 to 70 inches. Brookston soils are underlain by limy till.

Mahalasville soils occur with the very dark colored, very poorly drained Kokomo soils in the depressional flats, with the somewhat poorly drained, light-colored Sleeth soils in flat areas or on slight rises, and with the well-drained Camden soils in sloping areas.

These soils are naturally high in organic-matter content, and additions of lime are not needed. The available moisture capacity is high. Favorable yields of most crops grown in the county can be produced.

Mahalasville silty clay loam (0 to 2 percent slopes) (Ml).—In many places bordering slopes, 3 inches of light-colored silt loam overlies dark-colored silty clay loam. Also included are small areas of light-colored, somewhat poorly drained Sleeth soils. In the northwestern part of the county, the depth to calcareous silt and sand is less than 42 inches in some places. In places where Mahalasville soils grade to Brookston soils, the amount of stratified material decreases and calcareous till may occur. Near Pendleton, on the rock-cut terraces along Fall Creek, limestone is at a depth of 42 to 60 inches in some places.

Wetness is the major hazard. In areas where the limestone is at a depth of 42 to 60 inches, tile should be installed only after investigations have insured that there are no humps in the limestone that will interfere with laying the tile. If this soil is adequately drained, it can be used intensively for crops. (Capability unit IIw–1; woodland group 11)

Mahalasville silt loam (0 to 2 percent slopes) (Mh).—This soil occurs in low swales and on depressional flats. It has less clay in the surface layer than Mahalasville silty clay loam. Wetness is the major hazard, but this soil is used intensively for crops. (Capability unit IIw–1; woodland group 11)

Mahalasville silty clay loam, limestone substratum (0 to 2 percent slopes) (Mm).—The surface layer of this soil ranges from very dark gray to black. Included in mapped areas are sizable areas that have a silt loam or a mucky surface layer. In some places just above the solid limestone, at a depth of 18 to 42 inches or more, a thin layer of silty material has weathered. In other areas limestone is at a depth of 18 to 42 inches.

Wetness is the major hazard, and the limestone near the surface makes this soil difficult to drain. Tile generally is not used, and if it is, it is laid in shallow ditches. This soil is suited mainly to corn, soybeans, and other row crops. (Capability unit IIIw–5; woodland group 11)

Miami Series

The Miami series consists of deep, moderately dark colored, well-drained soils on nearly level to steep uplands. These soils occur along drainageways and streams and on knolls within areas of more poorly drained soils. They developed in till.

The brown to yellowish-brown silt loam surface layer is about 12 inches thick. The subsoil is dark-brown clay loam and silty clay loam about 16 inches thick. It is underlain by brown limy loam to light clay loam till that ranges from 24 to 42 inches in depth.

Miami soils have a coarser textured subsoil than Morley soils because the till in which Miami soils developed is coarser textured than the clay loam to silty clay loam till of the Morley soils.

Miami soils occur with the moderately well drained Celina soils on gentle slopes, with the somewhat poorly drained Crosby soils on nearly level flats, with the very poorly drained Brookston soils in depressions, with the very poorly drained, very dark colored Kokomo soils in the lowest areas, and with the excessively drained Hennepin soils on steep slopes.

The plow layer of Miami soils is medium acid if it has not been limed. Crops on these soils repond well to applications of lime and a complete fertilizer. Protection from erosion is needed. Water moves through the subsoil at a moderate rate.

Miami silt loam, 0 to 2 percent slopes (MnA).—This soil occurs in broad, level or nearly level areas adjacent to steeper slopes. It is in large areas near Sly Fork. In many places gravel and sand are beneath the till at a depth of 8 feet or more. A few glacial pebbles are on the surface. Included in mapped areas are a few small areas of the moderately well drained Celina soils. Also included are moderately eroded knobs.

This nearly level soil is highly productive and is not seriously limited in its use for crops. It has high available moisture capacity. Most of its acreage is cropland that can be cultivated intensively. (Capability unit I–1; woodland group 1)

Miami silt loam, 2 to 6 percent slopes, moderately eroded (MnB2).—This soil occurs along drainageways and on low knolls and divides amid nearly level and depressional soils. Erosion is slight on about 20 percent of the acreage. The soil has a surface layer consisting of the original dark yellowish-brown surface soil mixed with a moderate amount of the dark-brown subsoil. In moder-

ately eroded areas the depth to limy till is generally less than in the slightly eroded areas. Included in mapped areas are small knolls of severely eroded Miami soils in which the plow layer is mainly material from the subsoil. Also included are areas of very poorly drained Brookston and Kokomo soils along drainageways and areas of moderately well drained Celina soils.

This productive soil is moderately susceptible to erosion that may be overcome by using contour tillage and a suitable cropping system. It has medium available moisture capacity. Runoff is slow to medium. (Capability unit IIe–1; woodland group 1)

Miami silt loam, 6 to 12 percent slopes, moderately eroded (MnC2).—This soil occurs on narrow breaks along the valley walls of Pipe Creek, Sly Fork, Fall Creek, and the White River and in broader areas dissected by small drainageways. Erosion is slight in areas that are in forest or permanent pasture. In cultivated areas the plow layer consists of a mixture of the dark yellowish-brown surface soil and the dark-brown clay loam subsoil. On the surface, pebbles are numerous and larger stones occur in many places. The depth to limy till is generally less in moderately eroded areas than in the slightly eroded areas. Included in mapping are a few small areas that have slopes of more than 12 percent. Also included, along the small drainageways, are long narrow strips of poorly drained Brookston and Kokomo soils.

This soil is suited to the crops commonly grown in the county, but it has rapid runoff and is highly susceptible to erosion. The available moisture capacity is medium. Appropriate practices are needed to conserve soil and water if this soil is cropped. (Capability unit IIIe–1; woodland group 1)

Miami silt loam, 12 to 18 percent slopes, moderately eroded (MnD2).—This soil occurs on narrow, steep breaks along the valley walls of Pipe Creek, Fall Creek, Kilbuck Creek, Sly Fork, and the White River. In areas of forest or permanent pasture, erosion has been slight. In cultivated areas the plow layer consists of the dark yellowish-brown surface soil mixed with the dark-brown clay loam subsoil. On the surface, pebbles are numerous and stones 2 to 6 inches in diameter occur in many places. Rill erosion is common in cultivated areas. In moderately eroded areas, the depth to limy till is less than in the slightly eroded areas. Included in mapped areas along drainageways are some small areas that have slopes of more than 18 percent. Also included are long narrow strips of somewhat poorly drained Crosby soils.

This soil is suited to small grain, meadow, and an occasional row crop. It has very rapid runoff and is highly susceptible to further erosion. The available moisture capacity is medium. Maintaining ground cover throughout the year is important. (Capability unit IVe–1; woodland group 1)

Miami silt loam, 18 to 25 percent slopes, moderately eroded (MnE2).—This soil occurs on the sharp breaks along the valley walls of the major streams in the county. Most of this soil is in forest or wooded pasture, but a small acreage is in permanent pasture. The depth to limy till is 19 to 24 inches. Included in mapping are slightly eroded areas and severely eroded areas.

This soil is suited to pasture and trees. Because runoff is very rapid, this soil would be highly susceptible to erosion if it were cultivated. The available moisture capacity is medium. (Capability unit VIe–1; woodland group 2)

Miami soils, 2 to 6 percent slopes, severely eroded (MpB3).—These soils occur primarily on breaks along glacial valleys and around the head of drainageways near the streams. Most of the surface layer has been lost through erosion. The plow layer consists mainly of the dark-brown clay loam or silty clay loam subsoil. These soils are harder to plow than the uneroded Miami soils. If these soils are plowed when wet, they are cloddy when they dry out, and a good seedbed is difficult to prepare. Glacial pebbles are numerous on the surface. Depth to limy till is 18 to 28 inches. Small gullies occur on the long slopes. Included in mapping are small areas of moderately eroded Miami soils and areas of very poorly drained Brookston and Kokomo soils.

These soils have severe limitations to cropping and are only moderately productive. Runoff is medium to rapid, and erosion is the major hazard. Available moisture capacity is medium. Although these soils are farmed with adjoining less eroded soils, they should receive special attention for controlling erosion and maintaining production. (Capability unit IIIe–1; woodland group 1)

Miami soils, 6 to 12 percent slopes, severely eroded (MpC3).—These soils occur on narrow breaks along the valley walls of Pipe Creek, Fall Creek, Kilbuck Creek, and the White River and along tributaries of these streams. In places most of the surface layer and some of the subsoil have been lost through erosion. The plow layer consists of the dark-brown clay loam or silty clay loam subsoil mixed with a small amount of the yellowish-brown surface soil. Many small pebbles occur on the surface, and larger stones are plowed up in many places. Depth to limy till is 16 to 24 inches. Included in mapped areas are a few small areas that have slopes of more than 12 percent. Also included along the small drainageways are narrow strips of very poorly drained Brookston and Kokomo soils.

These soils are best suited to small grain, meadow, and an occasional row crop. They have very rapid runoff and are highly susceptible to erosion. Fertility is low, and available moisture capacity is medium. Maintaining ground cover throughout the year is important. (Capability unit IVe–1; woodland group 1)

Miami soils, 12 to 18 percent slopes, severely eroded (MpD3).—These soils occur on narrow, steep breaks on the slopes of the valleys along Pipe Creek, Fall Creek, Kilbuck Creek, Sly Fork, and the White River. The plow layer consists of the dark-brown silty clay loam subsoil mixed with a small amount of the yellowish-brown surface soil. These soils are difficult to plow, become cloddy when they dry, and make a very poor seedbed. Many small pebbles are on the surface, and larger stones are plowed up in many places. Limy till is generally at a depth of 12 to 20 inches, but in a few places it is on the surface because all of the subsoil has washed away. Included in mapped areas are small areas that are moderately eroded or have slopes of more than 18 percent.

These soils are suited to pasture and trees. They have very rapid runoff and are highly susceptible to erosion. Available moisture capacity is medium. (Capability unit VIe-1; woodland group 1)

Miami soils, 18 to 25 percent slopes, severely eroded (MpE3).—These soils occupy the sharp breaks along the valley walls of the major streams in the county. Most areas of these soils are in permanent pasture. The surface

layer, mostly material that formerly was subsoil, is clay loam to silty clay loam. In small areas the till is on the surface, and in other places it is near the surface. These soils have rapid runoff and are highly susceptible to erosion. Because available moisture capacity is low, shallow-rooted crops do not take in enough moisture. However, moisture is sufficient for good growth of trees. (Capability unit VIe-1; woodland group 2)

Morley Series

The Morley series consists of moderately dark colored, deep, moderately well drained and well drained soils on uplands. These soils occur in the northeastern corner of the county on low knolls and on slopes along drainageways and streams.

In cultivated areas the plow layer is grayish-brown silt loam 7 to 10 inches thick. In noncultivated areas the surface layer is very dark grayish brown. The subsoil, about 19 inches thick, is dark-brown to dark yellowish-brown silty clay loam. Till consisting of yellowish-brown, limy clay loam to silty clay loam underlies these soils at a depth that is generally 26 inches but that ranges from 20 to 40 inches or more.

The thickness of Morley soils above the till varies according to the topography. These soils are 38 inches to the limy till where there is a loess cap about 10 inches thick. In the more rolling areas where there is no loess cap or only a thin one, the depth to limy till is about 20 inches.

Morley soils have more clay in the subsoil and underlying till than Miami soils, and the till is nearer the surface. Also, the till is clay loam to silty clay loam in the Morley soils, but it is loam to light clay loam in the Miami soils.

Morley soils occur with the poorly drained, dark-colored Pewamo soils in depressions and with the somewhat poorly drained, light-colored to moderately dark colored Blount soils on nearly level to gentle slopes.

Morley soils have high available moisture capacity on the more gentle slopes. The plow layer is medium acid in areas that have not been limed. Crops on these soils respond well to additions of lime and a complete fertilizer, but protection from erosion is needed.

Morley silt loam, 2 to 6 percent slopes, moderately eroded (MrB2).—This soil occurs along drainageways and on low knolls amid nearly level and depressional soils. In a few small areas of woodland and permanent pasture, erosion has been slight. In cultivated areas the surface layer consists of a mixture of the original grayish-brown surface soil and a moderate amount of yellowish-brown subsoil. Included in areas mapped as this soil are small areas of somewhat poorly drained Blount soils or very poorly drained Pewamo soils.

This soil is moderately susceptible to erosion, but it produces favorable yields if it is managed well. The available moisture capacity is medium to high. Erosion can be controlled by contour tillage and by using a suitable cropping system. (Capability unit IIe-6; woodland group 1)

Morley silt loam, 6 to 12 percent slopes, moderately eroded (MrC2).—This soil occurs on narrow breaks along the valleys of Pipe Creek and Mud Creek and on ridges in broader areas that are dissected by small drainageways. Erosion has been slight in some places, but in most areas it is moderate, and the plow layer consists of a mixture of the yellowish-brown subsoil and the grayish-brown surface layer. The depth to limy till is about 20 inches. Included in mapped areas are areas of severely eroded Morley soils that are too small to be shown separately on the soil map.

Although this soil is suited to crops commonly grown in the county, it is highly susceptible to erosion and has only medium available moisture capacity. Using practices to conserve soil and water is important. (Capability unit IIIe-6; woodland group 1)

Morley silt loam, 12 to 18 percent slopes (MrD).—This soil occurs on steep breaks along the valleys of Pipe Creek and Mud Creek. These areas are in permanent pasture or forest. Included in mapped areas are small areas that are severely eroded or have slopes of more than 18 percent.

This soil is highly susceptible to erosion and has only low to medium available moisture capacity. It is best suited to small grain or meadow, but a row crop can be grown occasionally. Yields are low to medium. Maintaining ground cover throughout the year is important. (Capability unit IVe-6; woodland group 1)

Morley soils, 2 to 6 percent slopes, severely eroded (MsB3).—These soils occur in small areas amid other Morley soils, primarily on breaks along glacial valleys and around the head of drainageways near streams. Most of the original surface layer has been lost through erosion, and the plow layer consists largely of yellowish-brown silty clay loam that was formerly subsoil. These soils are difficult to plow, and they are cloddy when they dry. Fertility and the organic-matter content are generally low. Areas mapped as these soils include small moderately eroded areas.

If these soils are cultivated, practices are needed to control the medium to rapid runoff. The available moisture capacity is medium to low, and crop yields are low. (Capability unit IIIe-6; woodland group 1)

Morley soils, 6 to 12 percent slopes, severely eroded (MsC3).—These soils occur on the breaks along the valleys of Mud Creek and Pipe Creek and their tributaries. Most of the surface layer and, in places, some of the subsoil have been lost through erosion. The plow layer consists of yellowish-brown silty clay loam that was formerly subsoil and of a small amount of the grayish-brown original surface layer. These soils are difficult to plow and are cloddy when they dry. Many small pebbles are on the surface, and larger stones are plowed up in many places. The depth to limy till ranges from 12 to 24 inches. Rills as much as 1 foot deep occur in many areas. Erosion is only moderate in some small areas.

These soils are best suited to small grain and meadow, but a row crop can be grown occasionally. They are highly susceptible to erosion, are low in fertility, and have medium to low available moisture capacity. Maintaining ground cover throughout the year is important. (Capability unit IVe-6; woodland group 1)

Morley soils, 12 to 18 percent slopes, severely eroded (MsD3).—These soils occur on steep breaks along the valleys of Pipe Creek and Mud Creek. The plow layer consists of yellowish-brown silty clay loam. Many stones and pebbles are on the surface, and the limy till is exposed in spots. Gullies 1 or 2 feet deep occur in some areas. In a

few areas in pasture or trees, erosion is only slight or moderate.

These soils are suited to permanent pasture and trees. They are highly susceptible to erosion and are low in fertility, organic-matter content, and available moisture capacity. (Capability unit VIe–1; woodland group 1)

Ockley Series

The Ockley series consists of deep, moderately dark colored, well-drained soils on terraces. These soils occur along the White River, Pipe Creek, and Fall Creek. They occupy nearly level to gently sloping terraces between the uplands and the bottom lands.

In cultivated areas the surface layer consists of about 10 inches of brown silt loam. The subsoil, about 50 inches thick, is brown to dark-brown light silty clay loam to gravelly clay loam. It is underlain by light yellowish-brown to brown layers of limy sand and gravel, generally at a depth of 60 inches, but the depth ranges from 42 to 70 inches or more.

In virgin areas a thin layer of very dark grayish-brown silt loam is over the layer of brown silt loam. Plowing mixes this layer with the underlying layers.

The Ockley soils have a thicker, more silty subsoil than the Fox soils, and sand and gravel is at a greater depth. The depth to the sand and gravel underlying the Fox soils ranges from 24 to 38 inches.

Ockley soils occur with the somewhat poorly drained, light-colored Sleeth soils and with the very poorly drained Westland and Kokomo soils on the broad depressional flats.

Ockley soils have medium to high available moisture capacity. Water moves through the subsoil at a moderate rate. The plow layer is medium acid, if it has not been limed. Crops on these soils respond well to applications of nitrogen and other fertilizer. Favorable yields of the crops common in the county can be obtained.

Ockley silt loam, 0 to 2 percent slopes (OcA).—This soil is similar to the soil described for the series. Included in mapping are small areas of somewhat poorly drained Sleeth soils and well-drained Fox soils. Also included in areas of this soil between the uplands and the bottoms are small areas of steeper, more eroded soils. In some areas several inches of poorly assorted sand and gravel mixed with silt and clay overlie the stratified sand and gravel.

This highly productive soil is not seriously limited in its use for crops. (Capability unit I–1; woodland group 1)

Ockley silt loam, 2 to 6 percent slopes (OcB).—This gently sloping soil occurs along the valleys of the major streams. It has a thinner surface layer than Ockley silt loam, 0 to 2 percent slopes. In most areas the plow layer consists of the grayish-brown surface soil mixed with a moderate amount of the brown subsoil. Included in areas mapped as this soil are a few acres that have a loamy surface layer. Also included are small areas of somewhat poorly drained Sleeth soils and well-drained Fox soils. In some places several inches of poorly assorted sand and gravel mixed with silt and clay overlie the stratified sand and gravel.

This productive soil has only moderate limitations if used for crops. Erosion is the major hazard, but runoff is only medium, as is the available moisture capacity. In cultivated areas protective measures are needed to control excessive runoff and erosion. (Capability unit IIe–1; woodland group 1)

Pewamo Series

The Pewamo series consists of deep, dark-colored, very poorly drained soils of the uplands. These soils occupy broad depressional flats, swales with many rounded projections, and narrow drainageways in the northeastern part of the county.

The surface layer consists of about 11 inches of very dark gray to black silty clay loam. The subsoil is gray silty clay loam to silty clay or clay loam that is mottled with yellowish brown to dark yellowish brown. Gray limy till of clay loam to silty clay loam texture underlies the subsoil at a depth that ranges from 34 to 60 inches but that is generally about 48 inches.

Pewamo soils have more clay in the subsoil and underlying till than the Brookston soils. The underlying till of the Pewamo soils is loam to silty clay loam, whereas that of the Westland soils is limy sand and gravel. The Mahalasville soils are underlain by thin layers of limy silt and fine sand.

Pewamo soils occur with the somewhat poorly drained Blount soils in nearly level to gently sloping areas and with Morley soils on steeper slopes. In many places Pewamo, Blount, and Morley soils are so intricately intermingled that managing them separately is difficult. In some places, however, Pewamo soils are in large areas that may be managed independently.

The available moisture capacity and general productivity of the Pewamo soils are very high. Internal drainage is slow, and runoff is very slow or ponded.

Pewamo silty clay loam (0 to 2 percent slopes) (Pc).—Small areas of this soil have thin layers of silt and fine sand between the subsoil and the calcareous till. The till is coarser textured than clay loam in some spots, especially near the boundary between the Brookston and Pewamo soils. Included with this soil in areas bordered by eroded slopes are areas that have less than 4 inches of silt loam over the silty clay loam surface layer. Also included are small areas of the moderately dark colored, somewhat poorly drained Blount soils and of other soils that are very dark colored and very poorly drained. In a few low spots 6 inches of muck is on the surface.

If good management and a suitable cropping system are used, this soil retains its high productivity of all crops common in the area. Lime generally is not needed. Wetness is the major hazard, and a combination of tile and surface drains is needed. (Capability unit IIw–1; woodland group 11)

Rodman Series

The Rodman series consists of moderately dark colored, shallow, well-drained soils that are underlain by stratified sand and gravel. These soils occur along the major streams of the county on the steep slopes of terraces.

The surface layer is 2 to 5 inches of very dark grayish-brown to dark-brown silt loam. In some places a thin layer of gravelly clay loam underlies the surface layer. Light yellowish-brown and brown limy sand and gravel are at a depth of 4 to 12 inches.

Rodman soils are shallower than the Fox soils and have a thinner surface layer and a much thinner subsoil. Sand and gravel are at a depth of 24 to 42 inches in the Fox soils. The underlying sand and gravel distinguish the Rodman soils from the Hennepin soils, which are underlain by calcareous till.

Rodman soils occur with the moderately sloping Fox soils.

Rodman soils have low available moisture capacity. Surface runoff is rapid because slopes are steep. The permeability is very rapid. General productivity is low.

Rodman soils, 12 to 50 percent slopes, eroded (RdE2).—Most of the acreage of these soils is on steep breaks along the major streams and is covered with trees or shrubs. Large boulders are common on the surface. Small areas are severely eroded and gullied.

These soils are better suited to permanent pasture or trees than to tilled crops. Droughtiness is the major limitation. (Capability unit VIIs–1; woodland group 19)

Ross Series

The Ross series consists of dark-colored, deep, well-drained alluvial soils that occur on slightly elevated, nearly level flood plains along the White River. These soils are flooded only when the river is exceptionally high.

The surface layer is 8 to 10 inches of very dark brown or very dark gray silt loam or loam. The subsurface soil, about the same color as the surface layer, extends to a depth of about 23 inches. The subsoil is reddish-brown or brown silt loam to fine sandy loam. In some places limy sand or gravel occurs at a depth of 3 feet or more.

Ross soils occur with the well-drained Genesee soils and have a darker colored, thicker surface layer. They also occur with the moderately well drained Eel soils, with the somewhat poorly drained Shoals soils, and with the poorly drained Sloan soils.

Ross soils have a high available moisture capacity. Runoff is slow, and internal drainage is medium.

Ross silt loam (0 to 2 percent slopes) (Rs).—This soil occurs on the flood plains of the White River and its tributaries. Included in mapped areas are small areas that have a silty clay loam surface layer. This soil is easy to work and, under good management, withstands heavy cropping without damage. Corn and soybeans are the principal crops. (Capability unit I–2; woodland group 23)

Ross loam (0 to 2 percent slopes) (Ro).—This soil is adjacent to the White River. It has more sand in the surface layer than Ross silt loam and is easier to cultivate. Also, it is more permeable and has a lighter colored surface layer. Included in mapped areas are some small areas that have a fine sandy loam surface layer. (Capability unit I–2; woodland group 23)

Shoals Series

Soils of the Shoals series are deep, moderately dark colored, and somewhat poorly drained. These soils occur on bottom lands along small creeks and in slight depressions or old meanders in the valleys of the larger streams. They are back from the main stream and adjacent to the uplands in many areas where additional water is added as seepage from the uplands.

The surface layer is 6 to 8 inches of dark grayish-brown silt loam. It is underlain by a subsurface soil of brown silt loam that is mottled with light gray and brownish yellow. Gray and dark reddish-brown limy silt loam underlies the subsurface soil.

The surface layer ranges from very dark grayish brown to grayish brown. It is neutral to mildly alkaline. Thin layers of loam occur in some areas at varying depths. Organic matter has accumulated in the surface layer of these soils, but there has been little other soil development.

The Shoals soils occur on stream bottoms with the moderately well drained Eel soils, with the well drained Genesee soils, and with the very poorly drained Sloan soils.

Shoals soils have a high available moisture capacity. Runoff and internal drainage are very slow. These soils are medium to high in general productivity if the crops are not damaged by floods.

Shoals silt loam (0 to 2 percent slopes) (Sh).—In some places this soil is so dissected that it is suited only to pasture and trees. In some areas limy gravel is at a depth of 18 to 42 inches.

If this soil is drained, it is suited to most crops commonly grown in the county except alfalfa and other deep-rooted legumes. It is best suited to corn and soybeans. Because water moves freely through this soil, tile is suitable for drainage if outlets are available. (Capability unit IIw–7; woodland group 13)

Sleeth Series

Soils of the Sleeth series are light colored to moderately dark colored, deep, and somewhat poorly drained. These soils occur on nearly level terraces in the valleys of Fall Creek, Pipe Creek, and the White River.

The surface layer, about 16 inches thick, is very dark grayish-brown silt loam. The subsoil, about 32 inches thick, is dark-gray silty clay loam or clay mottled with yellowish brown. Layers of gray to dark-gray gravel and sand generally underlie the subsoil at a depth of 48 inches, but in some places the underlying material is silt and fine sand and a loamy substratum phase is mapped.

The surface layer ranges from very dark grayish brown to light grayish brown. Depth to the limy sand and gravel ranges from 42 to 70 inches or more.

Sleeth soils have limy sand and gravel at a depth of more than 42 inches, whereas the depth to sand and gravel is less than 42 inches in the Homer soils.

Sleeth soils occur with the well-drained Ockley soils but are lower in the landscape. They also occur with the Westland and Kokomo soils, which occupy depressional flats.

The plow layer of the Sleeth soils is medium acid where it has not been limed. These soils have high available moisture capacity and medium to high general productivity.

Sleeth silt loam (0 to 2 percent slopes) (Sl).—In many swales the surface layer of this soil is 10 to 19 inches thick. In some areas the underlying gravel and sand is poorly assorted and is mixed with silt and clay. Areas mapped as this soil include small areas of the dark-colored, very poorly drained Westland or Kokomo soils and the gently sloping, moderately eroded Ockley soils.

This soil is well suited to corn and other grain. Wetness is the major hazard. Because the water table is high in

spring, artificial drainage is needed. Tile and open drains can be used. (Capability unit IIw–2; woodland group 5)

Sleeth silt loam, loamy substratum (0 to 2 percent slopes) (Sm).—In front of the Union City moraine, especially in the western part of the county, the depth to calcareous material is less than 42 inches. In some places the underlying material is predominantly silt instead of stratified silt and sand. Included in mapped areas are small areas that have a loam surface layer.

The water table is high in spring, and artificial drainage is needed to insure consistent production. If tile lines are installed, measures should be taken to prevent silting. (Capability unit IIw–2; woodland group 5)

Sloan Series

The Sloan series consists of deep, dark-colored, very poorly drained soils on bottom lands. These soils occur in slight depressions within broad areas of better drained soils and along the base of steep slopes where there is seepage.

The surface layer is 8 to 12 inches of very dark gray silt loam. It is underlain by very dark gray to dark gray silt loam to silty clay loam that is mottled with yellowish brown and is underlain, in turn, by dark gray silt loam mottled with pale brown.

The Sloan soils occur with the somewhat poorly drained Shoals, with the moderately well drained Eel, and with the well drained Genesee and Ross soils.

Sloan soils have a high available moisture capacity. Runoff is very slow to ponded, and internal drainage is slow. These soils are productive if the crops are not damaged by floods.

Sloan silt loam (0 to 2 percent slopes) (So).—This soil is similar to the soil described for the series. Included in mapped areas are small areas that have a silty clay loam surface layer. Limy sand and gravel occur below a depth of 34 inches in some areas.

If this soil is drained, it is well suited to corn, soybeans, and other crops that can be planted after the floods in spring and can be harvested before the rains in fall. Tile works satisfactorily if adequate outlets are available. Undrained areas are in permanent pasture or trees. (Capability unit IIIw–9; woodland group 11)

Wallkill Series

The Wallkill series consists of deep, light-colored to moderately dark colored, very poorly drained soils. These soils occur in low swales or glacial channels where mineral soil material has recently washed in from surrounding slopes and has accumulated over black mucky soils.

The plow layer, about 8 inches thick, is very dark gray silt loam. It is underlain by very dark gray silt loam to silty clay loam that ranges from a few inches to about 30 inches in thickness and is underlain, in turn, by black muck. The muck is 2 feet or more thick in most places. Beneath the muck is dark yellowish-brown peat, gray limy clay, silt, sand, gravel, or limy marl.

The thickness of the material that washed in ranges from 10 to 40 inches. The depth to limy material ranges from 40 to 65 inches.

Wallkill soils are underlain by muck, whereas the Washtenaw soils are underlain by very dark colored mineral soils.

Wallkill soils are naturally high in fertility and need additions of lime in only a few places. They have a high available moisture capacity. Runoff is very slow or ponded.

Wallkill complex (0 to 2 percent slopes) (Wa).—Except for the variable texture, the soils in this complex have a profile similar to the one described for the series. The washed in soil material is less than 10 inches thick where these soils are near the soils that have a muck surface layer.

The soils of this complex require artificial drainage if yields are to be favorable. In most places tile removes excess water effectively, but open ditches may also be needed. Suitable outlets for drainage are hard to find in some places. Under good management, these soils produce favorable yields of corn and other crops. (Capability unit IIw–7; woodland group 23)

Washtenaw Series

Soils of the Washtenaw series are deep, light colored to moderately dark colored, and very poorly drained. They occur in potholes and along the edges of valleys where the soil has washed in from surrounding slopes and has accumulated over dark-colored soils.

The surface layer is very dark grayish-brown silt loam. The silty clay loam or clay loam subsoil, about 48 inches thick, is dark gray mottled with yellowish brown. The underlying material is gray limy silt and fine sand, limy till, or layers of sand and gravel.

The thickness of the material that was washed in ranges from 10 to 40 inches. Depth to limy material ranges from 46 to 70 inches.

The layer of washed in material distinguishes the Washtenaw soils from the Westland, Mahalasville, Brookston, and Pewamo soils, for those soils lack material that washed in, or they have only a few inches of it. Although Wallkill soils have a mineral surface layer, they are underlain by muck or peat.

Washtenaw soils seldom need lime and are naturally high in fertility. They have a high available moisture capacity. Runoff is very slow or ponded.

Washtenaw complex (0 to 2 percent slopes) (Wc). Except for the variable texture of the surface layer, the soils of this complex are like the soil described for the series. The material washed onto these soils is less than 10 inches thick where the soils adjoin dark-colored, very poorly drained soils.

Under good management, these soils produce favorable yields of corn and other crops. Artificial drainage is needed if yields are to be favorable. If outlets are available, tile is normally effective in removing excess water. (Capability unit IIw–1; woodland group 11)

Westland Series

The Westland series consists of deep, dark-colored, very poorly drained soils on terraces. These soils occupy broad depressional flats along the White River, Mud Creek, Pipe Creek, Kilbuck Creek, Fall Creek, and some smaller streams.

The surface layer, about 14 inches thick, is a very dark brown or black silty clay loam. The subsoil, about 35 inches thick, is dark-gray silty clay loam to clay loam mottled with yellowish brown. Gray and light yellowish-

brown layers of limy sand and gravel underlie the subsoil at a depth of about 49 inches.

The surface layer is silty clay loam in most places, but in some areas it is coarser textured. Depth to limy sand and gravel ranges from 24 to 70 inches or more.

The underlying sand and gravel distinguish the Westland soils from the Mahalasville soils, which are underlain by layers of silt and fine sand, and from the Brookston and Pewamo soils, which are underlain by till.

Westland soils occur with the very poorly drained, very dark colored Kokomo soils, with the somewhat poorly drained Sleeth soils, and with the well-drained Ockley soils.

Although Westland soils are generally neutral, applications of lime may be needed occasionally. These soils are well supplied with organic matter, but if cropping is heavy, crop residues should be mixed into these soils to maintain good tilth. The available moisture capacity is high. If management is good and the cropping system is suitable, these soils retain their high productivity of all crops common in the county.

Westland silty clay loam (0 to 2 percent slopes) (Wd). In this soil depth to the underlying sand and gravel is more than 42 inches. A thin layer of poorly assorted sand and gravel mixed with silt and clay occurs below the subsoil in some places. In small areas layers of silt and sand are between the silty clay loam subsoil and the underlying limy sand and gravel. The material that washed in is less than 10 inches thick in areas bordering severely eroded soils. Included in mapped areas are areas of the very dark colored Kokomo soils in low depressions. These areas are shown on the soil map by the symbol for swamp.

Wetness is the major hazard, and artificial drainage is needed if crops are grown. Tile is generally effective in removing excess water. (Capability unit IIw–1; woodland group 11)

Westland silty clay loam, moderately deep (0 to 2 percent slopes) (Ws).—This soil has a high content of organic matter. The sand and gravel underlying this soil is at a depth of less than 42 inches. Included in mapped areas are small areas of recent deposition that have a silt loam surface layer that is lighter colored than the surface layer of this soil. Also included, along Prairie Creek, are areas that have a black mucky surface layer.

If this soil is drained, it is suited to corn, soybeans, and other crops. Tile may be used for drainage, but special installation is needed because gravel and sand are near the surface. Open drains are satisfactory for lowering the water table and for removing excess water from the surface. (Capability unit IIw–4; woodland group 11)

Use and Management of the Soils

The soils of Madison County are used mainly for growing cash grain and for producing livestock. This section explains how the soils may be managed for these main uses, and also how they may be managed as woodland, for wildlife, and for building highways, farm ponds, and similar engineering structures. Also, the soils are rated according to their limitations if used as building sites and as disposal fields for septic tanks. In addition, the predicted yields of the principal crops are given under two levels of management. In presenting the information, the soils that require similar management are grouped, the group is described, and suitable practices of management are suggested.

Capability Groups of Soils

The capability classification is a grouping of soils that shows, in a general way, how suitable the soils are for most kinds of farming. It is a practical grouping based on limitations of the soils, the risk of damage when they are used, and the way they respond to treatment.

In this system all the kinds of soil are grouped at three levels, the capability class, subclass, and unit. The eight capability classes in the broadest grouping are designated by Roman numerals I through VIII. In class I are the soils that have few limitations, the widest range of use, and the least risk of damage when they are used. The soils in the other classes have progressively greater natural limitations. In class VIII are soils and landforms so rough, shallow, or otherwise limited that they do not produce worthwhile yields of crops, forage, or wood products.

The subclasses indicate major kinds of limitations within the classes. Within most of the classes there can be as many as four subclasses. The subclass is indicated by adding a small letter, *e*, *w*, *s*, or *c*, to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* means that water in or on the soil will interfere with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the country, indicates that the chief limitation is climate that is too cold or too dry.

In class I there are no subclasses, because the soils of this class have few or no limitations. Class V can contain, at the most, only subclasses *w*, *s*, and *c*, because the soils in it are subject to little or no erosion but have other limitations that restrict their use largely to pasture, range, woodland, or wildlife.

Within the subclasses are the capability units, which are groups of soils enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity and other responses to management. Thus, the capability unit is a convenient grouping of soils for which statements can be made about soil management. Capability units are generally identified by numbers assigned locally, for example, IIe–1 or IIe–6. The capability units in this county are not numbered consecutively, because they are part of a broad system that includes units not in the county.

Soils are classified in capability classes, subclasses, and units in accordance with the degree and kind of their permanent limitations; but without consideration of major and generally expensive landforming that would change the slope, depth, or other characteristics of the soil; and without consideration of possible but unlikely major reclamation projects.

The eight classes in the capability system, and the subclasses and units in this county, are described in the list that follows.

Class I.—Soils that have few limitations that restrict their use.
(No subclasses)
Capability unit I–1.—Nearly level, moderately dark colored, deep, moderately well drained or well drained soils of uplands and terraces.
Capability unit I–2.—Deep, nearly level, well-drained soils of flood plains.

Class II.—Soils that have some limitations that reduce the choice of plants or require moderate conservation practices.
Subclass IIe.—Soils subject to moderate erosion if they are not protected.
Capability unit IIe–1.—Gently sloping, deep, moderately dark colored, moderately well drained or well drained soils of uplands and terraces.
Capability unit IIe–6.—Deep, moderately dark colored, moderately well drained or well drained soils that are on uplands and have a medium-textured to fine-textured subsoil and substratum.
Capability unit IIe–9.—Gently sloping, moderately deep, well-drained soils on terraces; sand and gravel at a depth of 24 to 42 inches.
Subclass IIw.—Soils that have moderate limitations because of excess water.
Capability unit IIw–1.—Nearly level or depressional, dark-colored, deep, very poorly drained soils of the uplands and terraces.
Capability unit IIw–2.—Nearly level to gently sloping, light-colored to moderately dark colored, deep, somewhat poorly drained soils of the uplands and terraces.
Capability unit IIw–4.—Nearly level to depressional, dark-colored, very poorly drained soils on terraces; sand and gravel at a depth of 24 to 42 inches.
Capability unit IIw–6.—Nearly level, light-colored to moderately dark colored, somewhat poorly drained soils on terraces; sand and gravel at a depth of 24 to 42 inches.
Capability unit IIw–7.—Nearly level to depressional, light-colored to moderately dark colored, very poorly drained to moderately well drained soils on flood plains.
Capability unit IIw–10.—Nearly level to depressional, dark-colored, deep organic soils over loam to light silty clay.
Subclass IIs.—Soils that have moderate limitations of moisture capacity.
Capability unit IIs–1.—Nearly level, moderately dark colored, well-drained soils on terraces; sand and gravel at a depth of 24 to 42 inches.
Capability unit IIs–4.—Nearly level, moderately dark colored, well-drained soils on terraces; limestone at a depth of 18 to 42 inches.

Class III.—Soils that have severe limitations that reduce the choice of plants, or require special conservation practices, or both.
Subclass IIIe.—Soils subject to severe erosion if they are cultivated and not protected.
Capability unit IIIe–1.—Gently sloping to sloping, moderately dark colored to light-colored soils that are on uplands and are deep and well drained.
Capability unit IIIe–6.—Gently sloping to sloping, moderately dark colored soils that are on uplands and are deep, moderately well drained or well drained, and have a medium-textured to fine-textured subsoil and substratum.
Capability unit IIIe–9.—Slightly eroded or moderately eroded, moderately dark colored, well-drained soils on sloping terraces; sand and gravel at a depth of 24 to 42 inches.
Subclass IIIw.—Soils that have severe limitations because of excess water.
Capability unit IIIw–5.—Nearly level to depressional, dark-colored, very poorly drained soils on terraces; limestone at a depth of 18 to 42 inches.
Capability unit IIIw–7.—Nearly level, moderately dark colored, somewhat poorly drained soils on terraces; limestone at a depth of 18 to 42 inches.
Capability unit IIIw–8.—Nearly level to depressional, dark-colored, deep organic soils.
Capability unit IIIw–9.—Nearly level to depressional, dark-colored, deep soils that are on flood plains and are very poorly drained.

Class IV.—Soils that have very severe limitations that restrict the choice of plants, require very careful management, or both.
Subclass IVe.—Soils subject to very severe erosion if they are cultivated and not protected.
Capability unit IVe–1.—Sloping to strongly sloping, moderately dark colored to light-colored soils that are on uplands and are deep, well drained, and moderately eroded to severely eroded.
Capability unit IVe–6.—Rolling and hilly, moderately dark colored to light-colored soils that are on uplands and are deep and moderately well drained and well drained; fine-textured subsoil and substratum.
Capability unit IVe–9.—Sloping to strongly sloping, moderately eroded and severely eroded, moderately dark colored to light-colored soils that are on terraces and are moderately deep and well drained; sand and gravel at a depth of 24 to 42 inches.
Subclass IVw.—Soils that have severe limitations for cultivation because of excess water.
Capability unit IVw–3.—Nearly level to depressional, dark-colored, moderately deep organic soils over marl.

Class V.—Soils not likely to erode that have other limitations, impractical to remove without major reclamation, that limit their use largely to pasture, woodland, or wildlife food and cover. (None in Madison County.)

Class VI.—Soils that have severe limitations that make them generally unsuitable for cultivation and limit their use largely to pasture, woodland, or wildlife food and cover.
Subclass VIe.—Soils severely limited, chiefly by risk of erosion if protective cover is not maintained.
Capability unit VIe–1.—Strongly sloping to steep, light-colored to moderately dark colored,

moderately well drained to well drained soils on uplands.

Class VII.—Soils that have very severe limitations that make them unsuitable for cultivation without major reclamation and that restrict their use largely to pasture, woodland, or wildlife.

Subclass VIIe.—Soils very severely limited, chiefly by risk of erosion if protective cover is not maintained.

Capability unit VIIe-2.—Steep, moderately dark colored, well-drained and excessively drained soils on uplands.

Subclass VIIs.—Soils very severely limited by moisture capacity.

Capability unit VIIs-1.—Strongly sloping to steep, moderately dark colored, well-drained and excessively drained soils on terraces.

Class VIII.—Soils and landforms that, without major reclamation, have limitations that preclude their use for commercial production of plants and that restrict their use to recreation, wildlife, water supply, or esthetic purposes. (None in Madison County.)

Management by capability units

In this subsection the soils of Madison County are placed in capability units and each unit is discussed. Each unit consists of soils that have about the same limitations, need about the same management, and respond to this management in about the same way. The discussions of the capability units describe the soils, list the soils in the units, name suitable crops or kinds of farming, and give suitable cropping systems and suggestions for management. The cropping systems given are only examples; other systems may be suited to the soils of a unit. Representatives of the Soil Conservation Service will help you select a cropping system suitable for your soils.

Because Made land, Clay pits, and Gravel pits are not generally used for farming, they are not placed in capability units. Some areas of Made land may be farmed, but each area should be examined individually. Small pastured areas of Blount soils are included in Clay pits, and some areas of Clay pits may be reforested. Some Gravel pits are filled with water and used for fishponds and recreational areas (fig. 9). Dry pits are generally used for pasture, but they can be reforested and used as wildlife habitat.

CAPABILITY UNIT I-1

This unit consists of deep, nearly level, moderately dark colored soils of the uplands and terraces. These soils are well drained or moderately well drained. They have a silt loam surface layer that is easy to work and is susceptible to little erosion. The available moisture capacity is good, and seldom are these soils too wet or too dry for crops. The soils are—

- Camden silt loam, 0 to 2 percent slopes.
- Celina silt loam, 0 to 2 percent slopes.
- Fox silt loam, till substratum, 0 to 2 percent slopes.
- Miami silt loam, 0 to 2 percent slopes.
- Ockley silt loam, 0 to 2 percent slopes.

These soils are well suited to field corn, soybeans, small grain, and legumes and to sweet corn, tomatoes, and other special crops. Pasture is excellent if deep-rooted legumes and grasses are seeded and management is good.

A suitable cropping system is 3 years of row crops and 1 year of a small grain and an intercrop. Under good management, these soils can be cropped intensively.

Periodic applications of lime are needed, for these soils are normally acid. They are medium to low in available phosphorus and potassium, but crops respond well to a complete fertilizer. If more than one crop of corn is grown successively, a fertilizer high in nitrogen is needed to maintain favorable yields. These soils can be kept in good tilth if the supply of organic matter is maintained by properly using crop residue.

Red oak, white oak, walnut, tulip-poplar, and other native trees produce timber of high quality. The small woodlots on these soils should be protected from fire and livestock.

Wildlife normally can be increased on these soils by using practices such as planting field borders, seeding ditchbanks, using cover crops, and planting hedgerows.

CAPABILITY UNIT I-2

This unit consists of deep, nearly level, well-drained soils of the flood plains. These soils have a moderately dark colored to dark colored surface layer that is loamy and easy to cultivate. They are moderately permeable and have high available moisture capacity. These soils are limy, productive, and well supplied with plant nutrients received naturally by flooding. Erosion is not a problem except where streambanks are cut. Between December and June, flooding is a slight hazard. The soils are—

- Genesee silt loam.
- Ross loam.
- Ross silt loam.

These soils are suited to corn and soybeans and produce favorable yields in years when the weather is good. Small grain is not commonly grown, because flooding is likely. Pasture is excellent if deep-rooted legumes or grasses are seeded and well managed. Although these soils are naturally fertile, they should be fertilized in amounts indicated by soil tests.

A good cropping system is continuous row crops. If row crops are used, chemicals are generally needed for controlling weeds, especially when slight flooding has prevented normal cultivation.

These soils do not require artificial drainage, but parts of them may be crossed by open ditches or tile lines that drain areas of other soils. If the hazard of flooding is great, large areas of these soils may be protected by levees. The banks of small streams and of open ditches should be protected so that cutting is prevented.

White ash, tulip-poplar, and black walnut produce timber of high quality on these soils. Except for open areas within existing woods, the planting of trees is not advisable.

Wildlife habitat can be improved by protecting streambanks, for then food and cover is provided and water is nearby. Also, fish benefit because the streams are improved.

CAPABILITY UNIT IIe-1

This unit consists of gently sloping, deep, moderately dark colored, slightly eroded or moderately eroded soils of the uplands and terraces. These soils are well drained or moderately well drained. They have a silt loam surface layer that is easily worked. Their subsoil and substratum

***Figure 9*.—Abandoned gravel pit used as a recreational area.**

are medium textured to fine textured. The available moisture capacity is good, but erosion is likely if conservation practices are not used. The soils are—

Camden silt loam, 2 to 6 percent slopes, moderately eroded.
Celina silt loam, 2 to 6 percent slopes, moderately eroded.
Fox silt loam, till substratum, 2 to 6 percent slopes.
Fox silt loam, till substratum, 2 to 6 percent slopes, moderately eroded.
Miami silt loam, 2 to 6 percent slopes, moderately eroded.
Ockley silt loam, 2 to 6 percent slopes.

These soils are well suited to corn, soybeans, small grain, and legumes and to tomatoes and other special crops. Yields from pasture are high. Seeding mixtures containing alfalfa, ladino clover, birdsfoot trefoil, orchardgrass, or bromegrass may be used.

To control erosion in cultivated areas, suitable combinations of cropping systems and mechanical practices are required. The intensity of the cropping system depends on the mechanical practices used with it. If mechanical practices are not used, a suitable cropping system is 2 years of row crops, 1 year of a small grain, and 2 years of meadow. If contour cultivation is used, a suitable cropping system consists of 4 years of row crops, 1 year of a small grain, and 1 year of meadow. If these soils are terraced, 3 years of row crops and an intercrop are suitable.

These soils require periodic applications of lime and commercial fertilizer because they are naturally acid and are only moderate in fertility. Phosphorus is the most needed plant nutrient, but if yields are to be favorable, a fertilizer high in nitrogen is also needed, particularly if corn follows corn in the cropping system.

For favorable yields, plow planting of row crops is necessary. Properly using crop residue and green-manure crops and adding available manure help to maintain the organic-matter content and to improve soil tilth. If a grass-legume pasture is grazed for more than 1 year, additional fertilizer is needed to maintain high production.

Sodded waterways are needed in drainageways that may be eroded by runoff water. The maintenance of these

waterways includes fertilization, timely mowing, and the lifting of tillage equipment when the waterways are crossed.

Under good management, tulip-poplar, red oak, and white oak produce timber of high quality, but most of the acreage of these soils is cleared and cultivated. Black locust, red pine, and white pine grow well if they are planted.

Wildlife on these soils is increased by managing the sod waterways so that they furnish nesting places and escape cover. Other ways to provide food and protection for small game and other wildlife are seeding field border strips, establishing linear travel lanes, and delaying the mowing of stubble fields.

CAPABILITY UNIT IIe-6

Morley silt loam, 2 to 6 percent slopes, moderately eroded, is the only soil in this unit. This soil is on uplands and is deep, moderately dark colored, and moderately well drained or well drained. Its silt loam surface layer is easily worked. The subsoil and parent material are medium textured to fine textured. The available moisture capacity is medium to high. Erosion is the major hazard.

This soil is well suited to corn, soybeans, small grain, and legumes and to tomatoes and other special crops. If mixtures containing alfalfa, ladino clover, birdsfoot trefoil, orchardgrass, or bromegrass are seeded for pasture, the pasture is successful under good management.

If mechanical practices are not used, a suitable cropping system is 2 years of row crops, 1 year of a small grain, and 2 years of meadow. If contour cultivation is used, 3 years of row crops, 1 year of a small grain, and 1 year of meadow are suitable.

This soil contains small amounts of available phosphorus, potassium, calcium, and organic matter, but crops respond well to additions of a complete fertilizer and of lime. By making use of crop residue, barnyard manure, and green manure, the content of organic matter is maintained and soil tilth is improved.

Tile generally is not needed, but tile mains may cross areas of this soil on their way to outlets.

Wherever water flows, sod waterways are needed. To keep them in dense sod, add fertilizer and mow the grass. Lift tillage equipment when crossing the waterways with farm machinery.

If woodland management is good, tulip-poplar, red oak, white oak, and walnut produce timber of high quality. Most of this soil, however, is cleared and cultivated. If black locust, red pine, and white pine are planted, they grow well.

Ways to improve wildlife habitat are seeding strips on the border of fields, planting cover for wildlife travel lanes, delaying the removal of stubble, and sodding the waterways.

CAPABILITY UNIT IIe-9

Fox silt loam, 2 to 6 percent slopes, moderately eroded, is the only soil in this capability unit. This soil is on terraces and is moderately dark colored, moderately deep, and well drained. Sand and gravel are at a depth of 24 to 42 inches or more. The surface layer is easy to work. The available moisture capacity and general productivity are medium. Erosion is the major hazard, but the depth to sand and gravel is also important.

This soil is well suited to corn, soybeans, small grain, and legumes. Crops that mature early do well on this soil, but those that grow the entire season are likely to be injured by drought. Alfalfa and other deep-rooted legumes grow well.

If this soil is cultivated, suitable cropping systems and conservation practices are required to control erosion. If mechanical practices are not used, a suitable cropping system is 2 years of row crops, 1 year of a small grain, and 1 year of meadow. If contour cultivation is used, 4 years of row crops and 1 year of a small grain and an intercrop are suitable.

This soil is acid and requires applications of lime. To obtain favorable yields, a fertilizer high in nitrogen is also needed if corn follows corn in the cropping system.

Controlling erosion is the principal problem on this soil, but droughtiness is also a problem because the underlying sand and gravel limit the available moisture capacity. Unless erosion is controlled, less moisture is available for plants. The content of organic matter and the available moisture capacity can be increased by seeding cover crops and turning them under. Also beneficial is the establishment and maintenance of grassed waterways.

The native vegetation is forest of mixed hardwoods in which oak and maple predominate. Red oak, white oak, tulip-poplar, and walnut produce timber of high quality if management is good. Black locust, red pine, and white pine are suitable for planting in the open areas of existing woodland.

The wildlife on this soil can be increased by seeding in odd areas and in strips along fields and by sodding and managing waterways.

CAPABILITY UNIT IIw-1

The soils in this unit are on uplands and terraces and are deep, nearly level or depressional, very poorly drained, and dark colored. These soils have a silt loam or silty clay loam surface layer that is easy to work when it is only moist. Water moves slowly through the clay subsoil. The available moisture capacity and productivity are high. Wetness is the major hazard. The soils are—

Brookston silty clay loam.
Brookston silt loam.
Kokomo silty clay loam.
Kokomo silty clay loam, gravelly substratum.
Kokomo mucky silty clay loam, gravelly substratum.
Kokomo silty clay loam, stratified substratum.
Kokomo mucky silt loam, stratified substratum.
Mahalasville silty clay loam.
Mahalasville silt loam.
Pewamo silty clay loam.
Washtenaw complex.
Westland silty clay loam.

These soils are well suited to field corn, soybeans, small grain, and legumes and to sweet corn, tomatoes, and other special crops. A suitable cropping system is row crops grown continuously or 3 years of row crops and 1 year of a small grain and an intercrop.

These soils are generally deficient in available potassium, but lime is seldom needed. Crops respond well to applications of a complete fertilizer.

Diversion terraces may be used to protect these soils from the water that flows onto them from higher ground. Sod waterways that can be used as outlets for the diversion terraces should be established and maintained where needed. If outlets are available, these soils normally can

Figure 10.—Installing a tile line.

be drained by a system of tile that has been properly installed (fig. 10). A complete system of tile is the best, but random tile is satisfactory, especially in draining isolated ponded areas. The sand and gravel underlying these soils may be a hazard if the tile is placed deeper than 4 feet. The tile should be supplemented by surface drainage. Furrows or shallow ditches may be used in draining pasture or meadow.

Pin oak, swamp white oak, soft maple, and a few tulip-poplar trees are grown on small undrained woodlots. Plantings are normally difficult because these soils are wet at planting time. Pin oak, white ash, tulip-poplar, and bur oak should be favored in an existing stand.

Wildlife can be improved on these soils by properly maintaining diversion terraces and sod waterways, by seeding and fencing the banks of ditches within areas of pasture, and by seeding strips along the borders of fields.

CAPABILITY UNIT IIw-2

In this unit are deep, nearly level to gently sloping, somewhat poorly drained soils of the uplands and terraces. The light-colored to moderately dark colored surface layer is easily worked when it is moist. Internal drainage is somewhat poor because water moves slowly through the clay subsoil. Unless tile and surface drains have been installed, these soils are very slow to dry out in the spring. The available moisture capacity is good. Wetness is the major hazard, and the gently sloping soils erode unless they are protected. The soils are—

Blount silt loam, 0 to 2 percent slopes.
Blount silt loam, 2 to 6 percent slopes, moderately eroded.
Crosby silt loam, 0 to 2 percent slopes.
Crosby silt loam, 2 to 6 percent slopes, moderately eroded.
Sleeth silt loam.
Sleeth silt loam, loamy substratum.

These soils are suited to corn, soybeans, small grain, and other general crops. Tomatoes and other special crops also may be grown. Legumes and grasses are planted for pasture or meadow.

Continuous row crops are suitable on the soils of this group that have slopes of 0 to 2 percent. On the soils having slopes of 2 to 6 percent, the cropping system should be adjusted according to the percent of slope and the length of slope. On slopes of 3 percent that are 200 feet long, 2 years of row crops, 1 year of a small grain, and 2 years of meadow are suitable if mechanical practices are not used. If contour cultivation is used on such slopes, 4 years of row crops, 1 year of a small grain, and 1 year of meadow are suitable.

These soils are acid and require periodic applications of lime and of a complete fertilizer. If favorable yields are to be obtained, a fertilizer high in nitrogen is also required, especially where corn follows corn in the cropping system.

A complete drainage system that provides both surface and tile drainage is needed on these soils. Ordinarily, the surface drains should be dug before the tile is laid so that the amount of tile can be kept at a minimum. Contour cultivation on these soils aggravates the problem of wetness and should not be used unless the soils are adequately tiled.

Minimum tillage is important because these soils have extremely weak structure in the surface layer, and the soil material tends to run together. Using all available barnyard manure, turning under green manure, and using crop residue help to maintain the organic-matter content and to improve soil tilth.

Pin oak, bur oak, beech, and tulip-poplar grow on these soils. The trees are of high quality if management is good. White pine, soft maple, and sycamore are suitable for planting in the open areas in existing woodlots.

To improve habitat for wildlife, avoid grazing ditchbanks, delay mowing until after small grain is harvested, and manage fence rows by maintaining desirable permanent vegetation.

CAPABILITY UNIT IIw-4

Westland silty clay loam, moderately deep—the only soil in this unit—is in the swales or depressions on the terraces. This dark-colored, very poorly drained soil is moderately deep; gravel and sand are at a depth of 24 to 42 inches or more. The fine-textured surface layer is easily worked when it is moist. Poor internal drainage prevents good growth of roots. This soil has a high water table and high available moisture capacity. General productivity is medium to high, but it can be improved by artificial drainage. Wetness is the major hazard.

This soil is suited to corn, soybeans, and other crops generally grown in the area. A suitable cropping system is row crops grown continuously.

This soil is medium to high in organic-matter content, high in available phosphorus, and low in available potassium. Commercial fertilizer should be applied in amounts indicated by soil tests.

Since this soil has a high water table, artificial drainage is needed. Open ditches or tile is suitable, but the tile should be specially laid because sand and gravel are at a

depth of 24 to 42 inches. One of the following practices is suitable for laying the tile: (1) place the tile on a mat of bituminously impregnated fiberglass, heavy plastic, or heavy asphaltic roofing and, to completely encase the tile, cover the top with a porous fiberglass mat; (2) place the tile on a mat as described in (1) and pack 6 inches of sawdust, straw, ground corncobs, or similar material around and over the tile (fig. 11); or (3) encase the tile with 6 inches of gravel, stones, or other inert material. To prevent material from sifting in and clogging the tile, the pieces of tile should be butted close together. Open ditches are used to lower the water table and to serve as an outlet for the tile lines (fig. 12).

Figure 11.—Backfilling tile trench with shredded cornstalks and corncobs.

Figure 12.—Ditchbank fully protected by fescue.

Pin oak, swamp white oak, soft maple, and elm grow in small undrained woodlots. New plantings are generally difficult to make because these soils are wet at planting time. Pin oak, white ash, and tulip-poplar should be favored in an existing stand.

Wildlife cover can be restored by seeding new ditchbanks. Wildlife that nest on the ground should be protected by delaying mowing and grazing of ditchbanks, diversions, and waterways until the young have left their nests.

CAPABILITY UNIT IIw-6

Homer silt loam is the only soil in this unit. It is on terraces and is nearly level, somewhat poorly drained, and moderately deep. Sand and gravel occur at a depth of 24 to 42 inches or more. The light-colored to moderately dark colored silt loam surface layer and upper subsoil are easily worked when they are moist. The gray subsoil is mottled and slowly permeable. The available moisture capacity and general productivity are medium. Erosion is a hazard, but wetness is the major hazard.

This soil is well suited to all general crops of the area. When adequate drainage is provided, alfalfa, clover, and other deep-rooted crops may be planted. A suitable cropping system is 3 years of row crops and 1 year of a small grain and an intercrop.

Because this soil is acid, additions of lime are needed if alfalfa or clover is grown. Regular applications of a complete fertilizer are also needed if crop yields are to be favorable. When corn follows corn in the cropping system, the fertilizer should be high in nitrogen. Adding barnyard manure and using crop residue are desirable ways of increasing the amount of organic matter.

Except in gently sloping areas, erosion can be controlled by using a suitable cropping system, adding manure, and using crop residue.

Reducing wetness is more difficult. The water table of this soil may be lowered by draining the surrounding lower, darker colored soils. If this drainage is not satisfactory, tile is needed. Since sand and gravel are at a depth of 24 to 42 inches or more, the tile should be encased as explained in the discussion of capability unit IIw-4. On the soil in this unit, surface drains and open ditches are needed to control the height of the water table so that the soil can be used efficiently (fig. 13).

Pin oak, bur oak, beech, and tulip-poplar grow on these soils and produce trees of good quality if management is

Figure 13.—Box-inlet drop spillway used to provide overfill control of surface water and protect tile outlet.

good. Open areas in existing woodlots should be planted with white pine, soft maple, and sycamore.

For improving wildlife habitat, avoid grazing ditchbanks, delay mowing until after small grain is harvested, and manage fence rows by maintaining desirable permanent vegetation.

CAPABILITY UNIT IIw-7

The soils in this unit consist of nearly level to depressional, deep, loamy soils on alluvial bottom lands. These soils are very poorly drained to moderately well drained and light colored to moderately dark colored. They have high available moisture capacity and are productive. Flooding is likely during spring. Wetness is the major hazard. The soils are

Eel silt loam.
Shoals silt loam.
Wallkill complex.

Wallkill complex, which consists of recent deposits of mineral soil over muck, has been placed in this capability unit, but areas in which the mineral soil is less than 20 inches thick are managed the same way as are the soils in capability unit IIIw-8.

The soils in capability unit IIw-7 are well suited to corn and soybeans, but at times crops are destroyed by flooding. Pasture and hay also do well on these soils, but water-tolerant grasses and legumes should be planted. A suitable cropping system is continuous row crops.

These soils are well supplied with plant nutrients, but a nitrogen fertilizer is needed if yields of corn are to be favorable. Fertilizer should be applied in amounts indicated by the results of soil tests.

Because of wetness and flooding, tile and surface drainage are needed. Random or parallel, shallow surface drains are used to remove impounded water and to supplement the tile.

Since weeds are a problem on these soils, especially if wetness delays normal cultivation, practices to control weeds are needed.

Sycamore, cottonwood, white ash, and soft maple grow in narrow woodlots along the streams. The seasonal flooding helps the seedlings to establish and the trees to grow. White pine, sycamore, and black locust are suitable for planting in open areas of existing woodlots.

Wildlife habitat can be improved by seeding and fencing ditches and by other practices.

CAPABILITY UNIT IIw-10

Linwood muck is the only soil in this capability unit. This organic soil is deep, dark colored, nearly level to depressional, and underlain by loam to light silty clay. It developed in former swamps and bogs of the uplands, terraces, and bottom lands. Water stands on the surface most of the time unless the soil is artificially drained. Drained areas are easy to work. The available moisture capacity and productivity are high. Wetness is the major problem, but slight wind erosion is likely when this soil is dry.

This soil is well suited to field corn and soybeans and to onions, carrots, sweet corn, and other special crops. Continuous row crops are suitable. Areas that are difficult to drain are generally in bluegrass pasture.

This soil is normally high in nitrogen but low in available potassium. Heavily cropped areas are deficient in available phosphorus. Large additions of fertilizer are needed if yields are to be favorable.

To drain this soil, open ditches are first dug, and the soil is allowed to settle for 3 to 5 years. The tile is laid in the underlying mineral soil, not in the muck. By controlling the height of the water table to prevent drying, the damage from wind erosion is decreased. Wind erosion is also decreased by protecting this soil with crop residue and by growing cover crops.

The native vegetation was marsh grasses and sedges, but elm, soft maple, and willow have invaded.

One of the many ways to improve this soil for wildlife is to seed and fence the ditchbanks. The vegetation not only supplies food and cover for wildlife but also prolongs the effective life of the ditch.

CAPABILITY UNIT IIs-1

This capability unit consists of nearly level, well-drained, moderately dark colored soils on terraces. These soils have a fine sandy loam or silt loam surface layer that is easy to work. Sand and gravel are at a depth of 24 to 42 inches. Water and roots penetrate these soils easily. Internal drainage is rapid, and available moisture capacity is medium or low. Droughtiness is the major hazard. The soils are—

Fox fine sandy loam, 0 to 2 percent slopes.
Fox silt loam, 0 to 2 percent slopes.

These soils are suited to corn, soybeans, small grain, and legumes. Crops that mature early are best because those that grow the entire season may be damaged by drought. Alfalfa, seeded alone or with bromegrass, grows well because it is drought resistant. Other deep-rooted legumes are also suitable.

A suitable cropping system is 2 years of row crops, 1 year of a small grain, and 1 year of meadow. Continuous row crops are suitable in irrigated areas.

Applications of lime are generally needed because these soils are naturally acid. Also needed is a complete fertilizer, but heavy applications are not advisable, especially on the fine sandy loam. To maintain favorable yields, a fertilizer high in nitrogen is needed if corn is grown continuously on the silt loam.

Adding organic matter to these soils helps to improve available moisture capacity. Organic matter can be added by turning under green manure, crop residue, and cover crops.

Red oak, white oak, tulip-poplar, and walnut produce timber of high quality if management is good. Most wooded areas are small.

Delaying the mowing of stubble fields and seeding strips at the field borders are two of the many ways to maintain wildlife habitat. The balance between wildlife and their food and cover is improved when the cropping systems described are used.

CAPABILITY UNIT IIs-4

Fox silt loam, limestone substratum, 0 to 2 percent slopes, is the only soil in this unit. This soil is nearly level and moderately dark colored. It occurs on well-drained terraces or on glacial drift over limestone. It is only moderately deep, for bedrock is at a depth of 18 to 42 inches. The silty surface soil is easily worked. Internal drainage is good, but the available moisture capacity is

only medium. This soil is droughty in areas where limestone is near the surface.

This soil is suited to corn, wheat, clover, or mixed hay. Fall-seeded small grain and deep-rooted legumes are best suited because the limestone is near the surface.

A suitable cropping system is 2 years of row crops, 1 year of a small grain, and 1 year of meadow.

Applications of lime are generally needed because this soil is slightly acid to medium acid. Also needed is a complete fertilizer. Additions of organic matter are beneficial because this soil tends to be droughty. These additions can be made by using crop residue, by adding barnyard manure, and by turning under the sod crops.

Establishing and maintaining sod waterways help control erosion in the gently sloping areas. The waterways should be fertilized, mowed, and kept in a dense sod. Tillage implements should be lifted when a waterway is crossed.

Red oak, white oak, tulip-poplar, and walnut produce timber of high quality if woodland management is good. Most areas of this unit are small isolated woodlots.

Some of the needs of wildlife can be provided by planting crops in strips and by using stiff-stemmed legumes as green-manure crops.

CAPABILITY UNIT IIIe-1

This unit consists of gently sloping to sloping, slightly eroded to severely eroded soils of the uplands. These soils are deep and well drained. Except in the severely eroded soils, the surface layer is silt loam, moderately dark colored, and easily worked. The severely eroded soils have a lighter colored, clayey surface layer that is hard to plow. The available moisture capacity and the general productivity of cultivated crops are medium to low. These soils have rapid runoff and are highly susceptible to erosion. Erosion is the major hazard. The soils are—

- Fox soils, till substratum, 2 to 6 percent slopes, severely eroded.
- Fox silt loam, till substratum, 6 to 12 percent slopes.
- Fox silt loam, till substratum, 6 to 12 percent slopes, moderately eroded.
- Miami silt loam, 6 to 12 percent slopes, moderately eroded.
- Miami soils, 2 to 6 percent slopes, severely eroded.

These soils are well suited to a cropping system consisting of meadow or pasture, but row crops respond well to good management that includes practices to control erosion. A cropping system suitable for the severely eroded soils that have slopes of 2 to 6 percent is 1 year of a row crop, 1 year of a small grain, and 2 years of meadow. When contour tillage is used on those soils, 2 years of row crops, 1 year of a small grain, and 2 years of meadow are suitable. On the slightly eroded and moderately eroded soils that have slopes of 6 to 12 percent, a suitable cropping system is 1 year of a row crop, 1 year of a small grain, and 3 years of meadow. When contour tillage is used on those soils, 1 year of a row crop, 1 year of a small grain, and 1 year of meadow are suitable. When stripcropping is used on the slightly eroded and moderately eroded soils that have slopes of 6 to 12 percent, 2 years of row crops, 1 year of a small grain, and 3 years of meadow are suitable.

Lime and fertilizer are needed if yields are to be favorable. Also desirable are additions of organic matter.

If the slightly eroded and moderately eroded soils are cultivated but conservation practices are not used, much of the friable surface layer is lost through erosion. If small areas of the severely eroded soils are within larger areas of the less eroded soils on slopes of the same length, the small areas are farmed with the larger areas but are given special attention that includes using a longer rotation than on the larger areas, using barnyard manure, turning under green manure, and using crop residue.

Contour cultivation, stripcropping, or terracing is needed to control erosion on all the soils in this unit. Sod waterways that can be used as outlets for the terraces should be established and maintained. Tillage implements should be lifted when waterways are crossed.

On hayfields and meadows, additions of lime and a complete fertilizer are needed. Deep-rooted legumes and grasses of high quality are suited to these soils and produce abundant pasture.

Red oak, white oak, tulip-poplar, and walnut produce timber of high quality when woodland management is good. Most wooded areas are small. Red pine, white pine, and black locust are suitable for planting.

Benefits to wildlife increase as conservation practices are improved. The cropping systems described provide food and cover if management is good. In small isolated areas of the severely eroded soils, a permanent cover of grasses, shrubs, or trees is desirable. Farm ponds can be constructed for fish and water-loving wildlife.

CAPABILITY UNIT IIIe-6

This unit consists of deep, gently sloping to sloping, moderately well drained or well drained soils on moderately eroded to severely eroded uplands. These soils are moderately dark colored and have a medium-textured to fine-textured subsoil and underlying material. The available moisture capacity and general productivity are medium to low. Erosion is the major hazard. The soils are—

- Morley silt loam, 6 to 12 percent slopes, moderately eroded.
- Morley soils, 2 to 6 percent slopes, severely eroded.

These soils are suited to a cropping system of meadow and pasture, but row crops respond well to good management that provides erosion control. A suitable cropping system for the mapping unit made up of severely eroded soils having slopes of 2 to 6 percent is 1 year of a row crop, 1 year of a small grain, and 2 years of meadow. When contour tillage is used on these soils, 2 years of row crops, 1 year of a small grain, and 1 year meadow are suitable. On the moderately eroded soil having slopes of 6 to 12 percent, a suitable cropping system is 1 year of a row crop, 1 year of a small grain, and 4 years of meadow. When contour tillage is used on this soil, 1 year of a row crop, 1 year of a small grain, and 2 years of meadow are suitable.

The soils in this unit normally have an acid surface layer and require additions of lime. If favorable yields are to be maintained, a complete fertilizer also should be applied.

Cultivated areas of these soils are susceptible to erosion, but erosion can be controlled by stripcropping and contour cultivation. By using barnyard manure and crop residue, organic matter is increased and erosion is decreased.

In places where small areas of the severely eroded Morley soil are within larger areas of less eroded Morley soils, the small, severely eroded areas should be given special attention. In areas large enough to farm separately, the cropping systems given for the soil on slopes of 2 to 6 percent are suitable.

Established sod waterways that are managed well prevent runoff from cutting gullies. When these waterways are crossed by tillage implements, the implements should be raised.

Red oak, white oak, tulip-poplar, and walnut produce timber of high quality if woodland management is good. Most wooded areas are small. Red pine, white pine, and black locust are suitable for planting on these soils.

Habitat for wildlife can be improved by using the cropping systems described, for they add to the cover that wildlife can use for protection. Fish and water-loving wildlife can be increased by building farm ponds.

CAPABILITY UNIT IIIe-9

This unit consists of moderately deep, well-drained, gently sloping and sloping soils on slightly eroded or moderately eroded terraces. These moderately dark colored soils are easily worked. Water moves readily through these soils, and roots grow freely above the gravel, which is at a depth of 24 to 42 inches. The available moisture capacity is medium or low, and the general productivity is medium. Erosion is the major hazard. The soils are—

Fox fine sandy loam, 2 to 6 percent slopes.
Fox silt loam, 6 to 12 percent slopes, moderately eroded.

These soils are well suited to wheat, fall-seeded grain, alfalfa, sweetclover, and other deep-rooted legumes. Yields are lower on the fine sandy loam than on the silt loam. On the fine sandy loam, early-maturing crops are desirable because crops that grow the entire season may be damaged by a lack of water. On the silt loam, many pastures that contain Kentucky bluegrass are thin, weedy, and dormant through the summer.

If mechanical practices are not used, a suitable cropping system is 1 year of a row crop and 2 years of meadow. When contour tillage is used, 1 year of a row crop, 1 year of a small grain, and 1 year of meadow are suitable.

Because these soils are naturally acid, additions of lime are needed. Crops respond well to a complete fertilizer, but heavy applications are not desirable on the fine sandy loam.

Erosion may be controlled by using contour cultivation and suitable cropping systems. The content of organic matter and the available moisture capacity are increased by adding barnyard manure and by turning under green-manure crops and cover crops. Sod waterways are needed in some places.

Black oak, red oak, white ash, and walnut produce timber of good quality if woodland management is good. In some areas white pine, red pine, or black locust are planted.

Among the practices that help to increase wildlife are contour stripcropping, seeding field borders, and sodding the waterways.

CAPABILITY UNIT IIIw-5

Mahalasville silty clay loam, limestone substratum, is the only soil in this capability unit. This soil is on terraces and is nearly level to depressional, dark colored, and moderately deep. It developed from glacial drift that is underlain by limestone at a depth of 18 to 42 inches. The fine-textured surface layer is easily worked when it is moist, but the gray mottled subsoil is slowly permeable. This soil has medium to high available moisture capacity and general productivity. Although wetness is the major problem, the depth to limestone is also important.

This soil is suited to row crops, chiefly corn and soybeans. Suitable for permanent pasture are timothy or tall fescue with birdsfoot trefoil, ladino clover, and other water-tolerant legumes. Clover and fall-seeded small grain are frequently damaged by winterkilling.

A suitable cropping system is 3 years of row crops and 1 year of a small grain and an intercrop.

Crops on this soil respond to applications of a complete fertilizer. Available potassium is particularly needed.

Diversions may be needed on this soil, especially where water runs in from higher ground. For these diversions, sod waterways should be established and maintained. Tile drainage generally is not suitable on this soil, because the limestone is near the surface. Tile mains may cross this soil on their way to an outlet, but the proposed route should be examined before the mains are laid because limestone is at a depth of 18 to 42 inches. Instead of the tile, shallow surface drains should be established where needed (fig. 14).

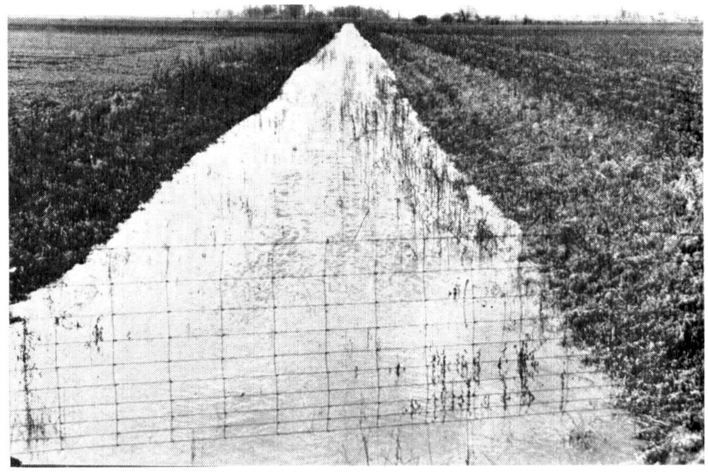

Figure 14.—**A shallow ditch in Mahalasville silty clay loam, limestone substratum.**

Pin oak, swamp white oak, soft maple, and elm grow in small undrained woodlots. New plantings are generally difficult to make because this soil is wet at planting time. If pin oak, white ash, and tulip-poplar are growing in an existing stand, they should be favored in the management.

Wildlife cover can be established by seeding the ditchbanks. Wildlife that nest on the ground can be protected by delaying the mowing and grazing on the ditchbanks, in diversions, and in waterways until the young have left their nest.

CAPABILITY UNIT IIIw-7

Homer silt loam, limestone substratum, is the only soil in this unit. It is on nearly level terraces and is moderately deep, moderately dark colored, and somewhat poorly drained. Limestone is at a depth of 18 to 42 inches. The silt loam surface layer is easily worked when it is moist, but the gray subsoil is mottled and slowly permeable, and the water table is high. Available moisture capacity and general productivity are medium. Runoff is slow, and erosion is slight. Wetness is the major hazard, but the depth to limestone is also important.

This soil is suited to row crops, especially corn and soybeans. Fall-seeded small grain and clover are frequently

damaged by winterkilling. Because birdsfoot trefoil and ladino clover are less susceptible to winterkilling than other legumes, they may be used as legumes in pasture mixtures.

A suitable cropping system on this soil is 3 years of row crops and 1 year of a small grain and an intercrop.

This soil is naturally acid and requires periodic applications of lime. A complete fertilizer is also required if favorable yields are to be maintained. To obtain favorable yields, additions of a fertilizer high in nitrogen are needed, especially if corn follows corn in the cropping system. Since organic matter is not plentiful in this soil, the supply should be increased by adding barnyard manure, using crop residue, and turning under green manure.

Shallow surface drains should be used to drain this soil because the limestone is near the surface and interferes with the laying of tile. Tile mains from areas of other soils, however, may cross parts of this soil on the way to outlets, but a thorough investigation along the route is required because solid rock is at a depth of 18 to 42 inches.

Pin oak, bur oak, beech, and tulip-poplar produce timber of high quality if woodland management is good. Suitable for planting open areas in the existing woodlots are white pine, soft maple, and sycamore.

Among the practices that increase wildlife are delaying the mowing of stubble fields and managing the shallow surface drains so that cover is provided.

CAPABILITY UNIT IIIw-8

Carlisle muck is the only soil in this unit. It developed in former swamps and bogs and consists of black muck and brown peat that extend from the surface to a depth of more than 42 inches. It is nearly level to depressional. Except where this soil is artificially drained, water stands on the surface most of the time. Wetness is the major hazard, but wind erosion is likely if the muck dries out and no cover protects it. The available moisture capacity and general productivity are high.

This soil is well suited to continuous row crops, but cover crops and green-manure crops should be grown when a row crop is not on the soil.

Since this soil is low in potassium, a fertilizer high in potash is needed if yields are to be favorable. By using crop residue and cover crops and by adding barnyard manure, the organic-matter content is maintained and plant nutrients are added to the soil.

In undrained areas bluegrass, tall fescue, and reed canarygrass can be used for permanent pasture. The pasture should be mowed only when the ground is dry enough to support machinery. Livestock should be kept off the pasture when it is wet.

Artificial drainage is needed if crops are grown. After open ditches are used for 3 to 5 years, and the soil has settled, tile can be laid. Runoff from the uplands can be intercepted by diversions. In areas where gravity outlets are not available, pumping is required. A program for controlled drainage is generally practical. Where field crops are grown, the water table should be held at about 30 to 36 inches below the surface.

The native vegetation was marsh grasses and sedges, but elm, soft maple, and willow have invaded.

Wildlife can be increased by fencing the diversions and open ditches and by delaying the mowing of permanent pasture.

CAPABILITY UNIT IIIw-9

Sloan silt loam is the only soil in this unit. It is on bottom lands and is deep, dark colored, very poorly drained, and nearly level to depressional. The silt loam surface layer is easy to work when it is moist. Permeability is slow, surface runoff is very slow, and ponding occurs in places. Flooding is likely because this soil is surrounded by areas of higher soils. The available moisture capacity is very high. This soil is very productive if it is drained.

This soil is well suited to corn and soybeans, but these crops are often destroyed by flooding. Water-tolerant grasses and legumes should be seeded in areas used for pasture or hay. Continuous row crops are best in drained areas of this soil.

Although this soil generally does not need any lime, a complete fertilizer is needed if favorable yields of corn are to be maintained. Shallow surface drains, random or parallel, are needed to remove impounded water and to supplement tile. Diversion ditches are also needed if this soil receives water from the nearby slopes. In many places locating suitable outlets is difficult.

Pin oak, bur oak, sycamore, and willow grow on this soil. New plantings are difficult to make because areas of this soil are ponded and flooded at planting time. Pin oak, bur oak, tulip-poplar, and white ash should be favored in existing stands.

Ditchbanks should be seeded and managed to improve wildlife habitat. The ditches in pastures should be fenced.

CAPABILITY UNIT IVe-1

This unit consists of sloping to strongly sloping, moderately eroded and severely eroded soils of the uplands. These soils are deep and well drained. The severely eroded soils are lighter colored than the moderately eroded one and are more difficult to work. Runoff is rapid or very rapid, and further erosion is the major hazard. The soils are—

Miami silt loam, 12 to 18 percent slopes, moderately eroded.
Miami soils, 6 to 12 percent slopes, severely eroded.

These soils are suited to small grain, hay, and an occasional row crop.

When mechanical practices are not used, a suitable cropping system on the mapping unit made up of the severely eroded soils is 1 year of a small grain and 2 years of meadow. When contour tillage is used on those soils, 1 year of a row crop, 1 year of a small grain, and 4 years of meadow are suitable. When mechanical practices are not used, permanent pasture is needed to control erosion on the moderately eroded soil. When contour cultivation is used on that soil, a suitable cropping system is 1 year of a small grain and 2 years of meadow.

These soils are naturally acid and require periodic applications of lime. A complete fertilizer is also needed if yields are to be favorable.

Special care to control erosion should be given small areas of the severely eroded soils within larger areas of the moderately eroded soil. By properly using crop residue and barnyard manure on the soils of this unit, soil moisture is conserved, organic matter is added, and soil tilth is improved. Deep-rooted legumes and adapted grasses, which produce excellent hay or pasture, are used to control erosion. Where the slope permits, the permanent pasture should be renovated when needed. Unless

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the slopes of 12 to 18 percent are covered with vegetation, the hazard of erosion is severe.

Red oak, white oak, tulip-poplar, and walnut produce timber of high quality in the small, scattered woodlots. White pine, red pine, and black locust can be planted in the severely eroded areas.

During the periods when meadow is grown, wildlife receives excellent protection from the additional cover. If the severely eroded areas are small and too irregular in shape for farming, they can be planted to trees and shrubs to provide protective cover for wildlife. Ponds can be constructed for fish and to benefit other wildlife.

CAPABILITY UNIT IVe-6

This unit consists of deep, moderately well drained and well drained, rolling and hilly soils on slightly eroded to severely eroded uplands. These soils are moderately dark colored to light colored and have a fine-textured subsoil and parent material. The surface layer is hard to plow when it is wet, and it becomes cloddy when it dries. The severely eroded soils have a clayey surface layer. Runoff on the soils of this unit is very rapid, and erosion is the greatest hazard. The lack of water, especially during dry periods, limits crop production. The soils are—

Morley silt loam, 12 to 18 percent slopes.
Morley soils, 6 to 12 percent slopes, severely eroded.

If mechanical practices are not used, a suitable cropping system on the severely eroded soils is 1 year of a small grain and 2 years of meadow. If contour tillage is used on those soils, 1 year of a row crop, 1 year of a small grain, and 5 years of meadow are suitable. Because the Morley silt loam is steep, it is best suited to hay or meadow.

These soils are normally acid and require periodic applications of lime. A complete fertilizer is also needed if the growth of plants is to be good.

Where the slopes are not too steep, pasture should be renovated when needed. The severely eroded areas should be turned back to permanent pasture so that further erosion is prevented. Establishing and maintaining sod waterways also help to control erosion.

Red oak, white oak, and walnut produce timber of high quality in the small, scattered areas of woodland. Protection from fire and livestock is needed on the woodland. White pine, red pine, and black locust can be planted in the severely eroded areas.

Because the cropping systems suitable for these soils provide long periods of grass cover, wildlife gain added protection and increase in number. Some sites on these soils are suitable for constructing ponds.

CAPABILITY UNIT IVe-9

This unit consists of moderately deep, well-drained, sloping to strongly sloping soils on moderately eroded and severely eroded terraces. Sand and gravel underlie these soils at a depth of about 24 to 42 inches. Surface runoff is rapid, and erosion is the greatest hazard. The severely eroded soils have a reddish-brown, clayey surface layer that is hard to cultivate when it is moist and that is cloddy when it is dry. The moderately eroded soil has a silt loam surface layer that is easy to work. These soils are low in available moisture capacity and produce low yields. The soils are—

Fox silt loam, 12 to 18 percent slopes, moderately eroded.
Fox soils, 6 to 12 percent slopes, severely eroded.

These soils are suitable for permanent vegetation or for a cropping system that lasts a long time and provides for small grain, hay, and a row crop every fourth or fifth year.

These soils are normally acid except where the limy sand and gravel are exposed at the surface. Applications of lime are needed in most places. To help the growth of plants, a complete fertilizer is also needed.

The amount of organic matter is small in these soils, but it can be increased by the use of barnyard manure and crop residue. Increasing organic matter helps to improve available moisture capacity. Establishing and maintaining sod waterways are ways of decreasing the loss of soil. Deep-rooted legumes, which produce excellent hay or pasture, should be used to control erosion.

Red oak, white oak, and tulip-poplar produce timber of high quality if woodland management is good. The woodlots are small and scattered. Open areas in woodland can be planted to pines.

Because the cropping systems suitable for these soils keep them in vegetation much of the time, excellent cover is provided for wildlife.

CAPABILITY UNIT IVw-3

Edwards muck is the only soil in this unit. This black organic soil is moderately deep over light-gray, soft, silty marl. It is in former swamps of the bottom lands, terraces, or uplands and is very poorly drained. Except in artificially drained areas, water stands on the surface. This soil has high available moisture capacity. It is easily worked and can produce favorable yields. The underlying marl can be plowed in some areas because it is at a depth that ranges from 12 to 42 inches. Wetness is the major problem, but the soil is susceptible to slight wind erosion when it is dry.

This muck is well suited to corn and soybeans, which can be grown continuously. Areas that are difficult to drain are generally in bluegrass pasture.

Although this soil is neutral in most places, small areas are slightly acid and may need lime. Nitrogen is plentiful, but there is little available potassium, especially where the marl is mixed with the surface soil. To obtain high crop yields, it is necessary to apply adequate amounts of potash and phosphate fertilizers.

Since wetness is a hazard, artificial drainage is necessary if crops are grown. Tile is not suitable. Open ditches are best in this soil, but diversions are also needed to intercept runoff from uplands. The water table can be controlled by use of inexpensive dams. The slight hazard of wind erosion can be lessened by using crop residue and seeding cover crops.

Soft maple and willow have invaded areas of this soil, which at one time were in marsh grass.

By seeding ditchbanks and fencing them, cover for wildlife is provided and the effective life of the ditch is lengthened.

CAPABILITY UNIT VIe-1

This unit consists of deep, moderately well drained to well drained, strongly sloping to steep soils on uplands. These soils are moderately eroded or severely eroded. During dry periods they do not hold as much water as crops are likely to need. The surface layer ranges from silt loam that is easily worked to clayey material that is hard to plow and cloddy when dry. Surface runoff is

very rapid, and erosion is the greatest hazard. General productivity is low. The soils are—

Miami silt loam, 18 to 25 percent slopes, moderately eroded.
Miami soils, 12 to 18 percent slopes, severely eroded.
Miami soils, 18 to 25 percent slopes, severely eroded.
Morley soils, 12 to 18 percent slopes, severely eroded.

These soils are best suited to permanent vegetation, but on Miami soils, 12 to 18 percent slopes, severely eroded, a cropping system that provides a small grain and meadow may be used if conservation practices are followed.

Additions of lime and fertilizer are needed on these soils if the growth of plants is to be good. Sod waterways are needed on soils used for a cropping system of a small grain and meadow. Good management of pasture prevents plants from weakening and weeds from invading. On slopes that are not too steep, permanent pasture should be renovated when needed.

Red oak, white oak, and tulip-poplar produce timber of high quality on steep soils if management is good. The severely eroded soils can be planted to pines and black locust.

By increasing permanent vegetation and by managing woodland well, the amount of wildlife on these soils is increased. If ponds are constructed, they can be stocked with fish, and the ponds also benefit other wildlife.

CAPABILITY UNIT VIIe-2

Hennepin soils, 18 to 35 percent slopes, eroded, are the only soils in this unit. These steep soils are on uplands and are well drained and have very rapid runoff. In uneroded areas the surface layer is moderately dark colored and friable, but in eroded areas it is lighter colored and more clayey in places. Erosion is the major hazard. These soils have low available moisture capacity and are too droughty for cultivated crops.

These soils should not be cultivated. Where the slope is not too steep, pasture should be established and maintained. Pasture plants grow well during spring, but not in the dry periods. A thin pasture can be improved by seeding legumes. A complete fertilizer is needed for obtaining favorable yields of forage.

The woodland areas of oak and tulip-poplar should be protected from fire and grazing. Open areas and areas too steep for pasture can be planted to white pine, red pine, and black locust.

Protecting the existing woodland from fire and livestock increases reproduction of trees and shrubs and benefits wildlife. The wildlife receive added protection from pasture that is managed well.

CAPABILITY UNIT VIIs-1

Rodman soils, 12 to 50 percent slopes, eroded, are the only soils in this unit. These soils are on eroded terraces, are excessively drained, and are strongly sloping to steep. They are shallow and droughty; limy sand and gravel are close to the surface. In uneroded areas the surface layer is dark-brown, friable silt loam or loam. In eroded areas, the surface layer is brown, but yellowish-brown sand and gravel are on the surface in places. Surface runoff is rapid, and the risk of erosion is moderate. Droughtiness is the major hazard.

These soils are suited to alfalfa and permanent pasture. Permanent vegetation, especially trees, is needed on the steeper or more eroded slopes. On the less steep slopes, a small grain can be grown if it is preceded by 4 years or more of hay or pasture. Also, a small grain can be grown as a nurse crop when meadow is reseeded. Contour tillage, stripcropping, terracing, or other practices are needed to control erosion. For favorable yields, applications of a complete fertilizer are needed.

The pasture on these soils is generally in good condition in spring and fall, but not during dry periods. Additions of organic matter help to control erosion and to increase the moisture supply.

Woodland in oak, hickory, and walnut should be protected from fire and livestock. Pines and black locust grow well on these soils.

Habitat for wildlife can be improved by managing the woodland well and by making new plantings. Added protection is given to game animals by good management of pasture and meadow.

Predicted Yields

In table 2 average yields of principal crops are listed for the soils in the county. In columns A are the yields to be expected under average, or medium, management; in columns B are the yields to be expected under improved management, or the high level of management that some farmers in the county are now practicing.

The yields are estimated averages for periods ranging from 5 to 10 years. These yields were estimated on the basis of farm records, the direct observation of soil scientists and work unit conservationists, and interviews with farmers, members of the staff of the Purdue Agricultural Experiment Station, and others familiar with the agriculture of the county. Considered in making the estimates were the prevailing climate, characteristics of the soils, and the influence of different kinds of management.

The yields in table 2 may not apply directly to specific tracts of land for any particular year, because the soils vary somewhat from place to place, management practices differ slightly from farm to farm, and the weather varies from year to year. Nevertheless, the estimates are as accurate a guide as can be obtained without further detailed and lengthy investigations. They are useful in showing the relative productivity of the soils and how soils respond to improved management.

The management needed for obtaining the yields of columns A consists of (1) using cropping systems that maintain tilth and organic matter; (2) using management that controls erosion enough that the favorable qualities of the soils are not greatly reduced; (3) applying moderate amounts of fertilizer and lime as determined by soil tests; (4) returning crop residues to the soil; (5) using conventional methods of plowing and other tillage; (6) planting crop varieties that are generally adapted to the climate and the soils; (7) controlling weeds moderately well by tillage and spraying; and (8) installing random drainage.

The management needed for obtaining the yields in columns B consists of (1) using cropping systems that maintain tilth and organic matter; (2) making maximum use of cultural practices, mechanical practices, or both, to control erosion so that the favorable qualities of the soils are maintained or improved; (3) maintaining high levels of available phosphorus, potassium, and nitrogen in the soil; (4) applying lime and fertilizer in amounts

Table 2.—*Estimated average yields of principal crops under two levels of management*

[In columns A are yields under average management; in columns B are yields under improved management. Absence of yield indicates that the soil is unsuitable for the crop or that the crop ordinarily is not grown on the soil]

Soil	Corn		Wheat		Oats		Soybeans		Red clover and timothy		Alfalfa and grass	
	A	B	A	B	A	B	A	B	A	B	A	B
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Tons*	*Tons*	*Tons*	*Tons*
Blount silt loam, 0 to 2 percent slopes	75	90	28	40	46	70	25	35	2.0	2.5	2.5	3.5
Blount silt loam, 2 to 6 percent slopes, moderately eroded	65	80	25	30	40	60	20	30	2.0	2.5	2.5	3.0
Brookston silt loam	81	107	32	45	57	78	32	40	2.5	3.0	3.0	4.0
Brookston silty clay loam	81	107	32	45	57	78	32	40	2.5	3.0	3.0	4.0
Camden silt loam, 0 to 2 percent slopes	75	105	37	45	60	80	30	40	2.0	3.0	3.0	4.0
Camden silt loam, 2 to 6 percent slopes, moderately eroded	65	100	35	43	55	70	25	35	2.0	2.8	3.0	3.5
Carlisle muck	75	110	28	36	-----	-----	30	38	-----	-----	-----	-----
Celina silt loam, 0 to 2 percent slopes	70	105	37	45	60	80	30	40	3.0	4.5	3.0	4.0
Celina silt loam, 2 to 6 percent slopes, moderately eroded	65	100	35	43	55	75	28	36	3.0	4.0	2.5	3.5
Clay pits	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Crosby silt loam, 0 to 2 percent slopes	75	90	30	40	46	60	26	35	2.5	4.0	2.5	3.5
Crosby silt loam, 2 to 6 percent slopes, moderately eroded	70	85	25	35	40	60	26	35	2.5	3.0	2.5	3.5
Edwards muck	60	80	-----	-----	-----	-----	25	35	-----	-----	-----	-----
Eel silt loam	80	100	32	40	54	71	29	40	2.0	3.0	-----	-----
Fox fine sandy loam, 0 to 2 percent slopes	60	80	25	35	40	60	20	25	2.0	2.8	2.5	3.0
Fox fine sandy loam, 2 to 6 percent slopes	60	75	25	35	40	60	20	25	2.0	2.8	2.5	3.0
Fox silt loam, 0 to 2 percent slopes	66	80	25	40	41	59	21	28	2.7	4.0	2.5	3.5
Fox silt loam, 2 to 6 percent slopes, moderately eroded	62	75	25	40	38	55	17	22	2.5	3.0	2.4	3.5
Fox silt loam, 6 to 12 percent slopes, moderately eroded	60	70	22	36	35	55	20	24	1.8	2.5	2.5	3.0
Fox silt loam, 12 to 18 percent slopes, moderately eroded	30	45	20	25	40	50	15	20	1.5	2.3	2.0	2.5
Fox silt loam, limestone substratum, 0 to 2 percent slopes	60	80	25	40	50	75	25	36	2.0	3.0	3.0	4.0
Fox silt loam, till substratum, 0 to 2 percent slopes	70	105	35	45	60	80	30	40	2.5	3.0	3.0	4.0
Fox silt loam, till substratum, 2 to 6 percent slopes	65	100	35	43	55	75	30	40	2.0	3.0	3.0	4.0
Fox silt loam, till substratum, 2 to 6 percent slopes, moderately eroded	65	100	35	43	55	75	30	40	2.0	3.0	2.0	3.5
Fox silt loam, till substratum, 6 to 12 percent slopes	55	85	30	38	50	65	20	30	2.0	2.8	2.0	3.0
Fox silt loam, till substratum, 6 to 12 percent slopes, moderately eroded	55	85	30	38	50	65	20	30	2.0	2.8	2.0	3.0
Fox soils, 6 to 12 percent slopes, severely eroded	30	45	20	25	40	50	15	20	1.5	2.3	2.0	2.5
Fox soils, till substratum, 2 to 6 percent slopes, severely eroded	50	80	25	35	45	60	20	30	1.5	2.0	2.0	2.5
Genesee silt loam	80	100	32	40	54	71	29	40	2.5	3.5	-----	-----
Gravel pits	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Hennepin soils, 18 to 35 percent slopes, eroded	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Homer silt loam	65	85	28	40	40	65	25	30	2.5	3.0	2.5	3.5
Homer silt loam, limestone substratum	60	80	28	40	40	65	25	30	2.0	3.0	2.5	3.5
Kokomo silty clay loam	75	105	35	43	60	80	30	40	2.0	3.0	2.5	3.5
Kokomo silty clay loam, gravelly substratum	80	115	25	35	54	75	30	38	2.5	3.0	3.0	4.0
Kokomo mucky silty clay loam, gravelly substratum	80	115	25	35	54	75	30	38	2.5	3.0	3.0	4.0
Kokomo silty clay loam, stratified substratum	75	105	30	40	60	80	30	40	2.0	3.0	-----	-----
Kokomo mucky silt loam, stratified substratum	75	105	30	40	60	80	30	40	2.0	3.0	-----	-----
Linwood muck	80	100	-----	-----	-----	-----	25	38	-----	-----	-----	-----
Made land	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Mahalasville silt loam	81	107	28	35	57	78	32	40	2.0	3.0	3.0	4.0
Mahalasville silty clay loam	81	107	28	35	57	78	32	40	2.0	3.0	3.0	4.0
Mahalasville silty clay loam, limestone substratum	60	90	26	35	55	78	30	36	2.0	3.0	3.0	4.0
Miami silt loam, 0 to 2 percent slopes	75	100	35	45	50	85	30	40	2.0	3.0	3.0	4.0
Miami silt loam, 2 to 6 percent slopes, moderately eroded	65	100	35	43	55	75	25	35	2.0	3.0	3.0	3.5
Miami silt loam, 6 to 12 percent slopes, moderately eroded	50	80	30	40	45	70	20	26	1.8	2.5	2.0	3.0
Miami silt loam, 12 to 18 percent slopes, moderately eroded	40	64	21	35	40	65	20	26	1.5	2.0	1.5	2.5

TABLE 2.—*Estimated average yields of principal crops under two levels of management*—Continued

Soil	Corn		Wheat		Oats		Soybeans		Red clover and timothy		Alfalfa and grass	
	A	B	A	B	A	B	A	B	A	B	A	B
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Tons*	*Tons*	*Tons*	*Tons*
Miami silt loam, 18 to 25 percent slopes, moderately eroded	----	----	----	----	----	----	----	----	----	----	----	----
Miami soils, 2 to 6 percent slopes, severely eroded	55	70	30	38	50	65	20	31	1.0	2.0	2.0	2.5
Miami soils, 6 to 12 percent slopes, severely eroded	40	65	20	30	45	65	18	25	1.0	2.0	2.0	2.5
Miami soils, 12 to 18 percent slopes, severely eroded	----	----	----	----	----	----	----	----	1.0	1.8	1.0	2.0
Miami soils, 18 to 25 percent slopes, severely eroded	----	----	----	----	----	----	----	----	----	----	----	----
Morley silt loam, 2 to 6 percent slopes, moderately eroded	50	75	25	35	45	65	25	30	1.5	3.0	2.5	3.5
Morley silt loam, 6 to 12 percent slopes, moderately eroded	45	65	25	32	40	60	20	27	1.5	2.4	2.0	3.0
Morley silt loam, 12 to 18 percent slopes	40	60	20	32	40	50	16	24	1.5	2.4	1.8	2.5
Morley soils, 2 to 6 percent slopes, severely eroded	55	80	27	35	40	60	20	25	1.0	2.5	2.0	2.5
Morley soils, 6 to 12 percent slopes, severely eroded	40	50	15	25	35	50	16	23	1.0	2.1	1.8	2.5
Morley soils, 12 to 18 percent slopes, severely eroded	----	----	----	----	----	----	----	----	----	----	----	----
Ockley silt loam, 0 to 2 percent slopes	75	105	35	45	60	80	30	40	2.0	3.0	3.0	5.0
Ockley silt loam, 2 to 6 percent slopes	65	100	35	43	55	75	25	40	2.0	3.0	3.0	5.0
Pewamo silty clay loam	75	105	30	45	50	85	28	36	2.0	3.0	3.0	4.0
Rodman soils, 12 to 50 percent slopes, eroded	----	----	----	----	----	----	----	----	----	----	----	----
Ross loam	80	100	38	43	54	71	34	40	2.0	3.0	----	----
Ross silt loam	80	100	38	43	54	71	34	40	2.0	3.0	----	----
Shoals silt loam	80	100	----	----	----	----	25	35	----	----	----	----
Sleeth silt loam	75	105	30	43	55	75	28	40	2.0	3.0	2.5	3.5
Sleeth silt loam, loamy substratum	75	105	30	43	55	75	28	40	2.0	3.0	2.5	3.5
Sloan silt loam	80	100	----	----	----	----	----	----	----	----	----	----
Wallkill complex	80	100	30	40	50	69	25	35	----	----	----	----
Washtenaw complex	75	107	32	40	50	70	25	35	2.0	3.0	3.0	4.0
Westland silty clay loam	75	105	32	40	60	80	25	35	2.0	3.0	3.0	4.0
Westland silty clay loam, moderately deep	75	110	30	40	50	70	30	40	2.0	3.0	3.0	4.0

indicated by soil tests and recommended by the State Agricultural Experiment Station; (5) utilizing crop residues to the fullest extent in order to protect and improve the soil; (6) practicing minimum tillage; (7) planting only the best-adapted crop varieties; (8) controlling weeds by tillage and spraying; and (9) installing complete systems of drainage on wet soils.

Woodland [2]

In this subsection the woodland of the county is broadly described and the soils of the county are placed in groups so that woodland management can be more easily discussed.

Hardwood forests originally covered most of Madison County. Harvested from these forests were valuable trees that were used for veneer and lumber. The soils, however, were suitable for farming, and most wooded areas were cleared of trees, whether for market or not. The Conservation Needs Inventory shows that in 1959 only 19,667 acres of woodland remained in the county. Much of this woodland is in poor condition, mainly because trees of high quality have been cut and those remaining are poorly formed and of low quality. The quality of the trees is further lowered by the grazing of hogs or cattle. Continual grazing compacts the soil, slows the growth of trees, and prevents the reseeding. Many more small wooded areas probably will be cleared so that they can be grazed. The protection of present woodland from livestock is essential if the woodland is to remain in trees.

[2] Prepared with the assistance of JOHN HOLWAGER, woodland conservationist, Soil Conservation Service.

Woodland suitability groups

To assist owners of woodland in planning the use of soils, the soils of Madison County have been placed in eight woodland groups. These groups are part of a broad system, and they are not numbered consecutively. Each group is made up of soils that are similar in potential productivity, that are suitable for similar trees, and that require similar management. These groups are given in table 3 and are described later in this subsection.

Listed in table 3 for each group are the site indexes of upland oaks, tulip-poplar, and pin oak. Site index is the total height, in feet, that trees of a given species, growing on a given soil in an even-aged, well-managed stand, will attain in 50 years. It is, therefore, a measure of potential productivity. The site indexes in table 3 are based on observations of trees in Madison County and in nearby places that have similar soils. Of the properties that determine the productivity of trees, the

TABLE 3.—*Woodland*

[Absence of a site index indicates that the tree

Woodland group	Potential productivity (site index at 50 years) [1]			Seedling mortality
	Upland oaks	Tulip-poplar	Pin oak	
Group 1: Deep or moderately deep, medium-textured, moderately well drained and well drained soils that are level or strongly sloping and have slow to medium runoff, moderate permeability, and moderate to high available moisture capacity.	85–95	90–105	----------	Slight or moderate
Group 2: Deep or moderately deep, medium-textured or moderately coarse textured, well-drained soils that are level to strongly sloping and have slow to rapid runoff and moderate permeability.	85–95	95–105	----------	Slight or moderate
Group 5: Deep or moderately deep, medium-textured, somewhat poorly drained soils that are on level plains and on gentle slopes of terraces and uplands and have slow runoff and permeability and high available moisture capacity.	80–92	90–100	85–100	Slight
Group 8: Deep, moderately coarse textured to moderately fine textured, well drained or moderately well drained soils that are in nearly level areas of the flood plains and have slow runoff, moderate permeability, and high available moisture capacity; periodically flooded.	----------	95–105	----------	Slight
Group 11: Deep or moderately deep, medium-textured or moderately fine textured, very poorly drained or poorly drained soils that are nearly level and depressional and have a seasonally high water table, slow to ponded runoff, slow permeability, and high available moisture capacity.	----------	90–105	85–105	Moderate
Group 13: Deep, medium-textured and moderately fine textured, somewhat poorly drained soil that is on bottom lands, is level or depressional, and has a seasonally high water table, slow to ponded runoff, slow permeability, and high available moisture capacity; periodically flooded.	----------	----------	90–105	Slight
Group 19: Shallow, medium-textured, well-drained gravelly soils that are strongly sloping to very steep and have medium to rapid runoff, rapid permeability, and low available moisture capacity.	60–70	----------	----------	Slight or moderate
Group 23: Soils and land types that are of minor or no importance for the production of timber.	----------	----------	----------	----------

[1] Site indexes were calculated by using tree measurements on 200 separate plots and, in calculation, by using the age-height curves in "Forestry Handbook" (*10*) for upland oaks (p. 6.45), and for tulip-poplar (p. 6.46). The curve for sweetgum (p. 6.44) was used to calculate the site index of pin oak.

suitability groups

is not commonly grown on the soils of the group]

Erosion hazard	Windthrow hazard	Equipment limitation	Suitable trees ²	
			Favored in existing stands	Favored for planting
Slight or moderate	Slight	Slight or moderate	Red oak, white oak, white ash, tulip-poplar, black walnut.	White pine, red pine, black locust.
Slight or moderate	Slight	Moderate	Red oak, white oak, white ash, tulip-poplar, black walnut.	White pine, red pine, black locust.
Slight	Moderate or severe	Moderate	Pin oak, soft maple, bur oak, white ash, tulip-poplar.	White pine, soft maple, sycamore.
Slight	Slight	Slight	Cottonwood, sycamore, tulip-poplar, black walnut, white ash.	White pine, cottonwood, black locust.
Slight	Moderate or severe	Severe	Pin oak, soft maple, bur oak, white ash, tulip-poplar.	(³).
Slight	Moderate	Moderate	Pin oak, soft maple, tulip-poplar.	White pine, cottonwood, sycamore.
Moderate or severe	Moderate	Moderate or severe	Chinquapin oak, red oak, basswood, white ash.	Black locust, white pine, jack pine.
------	------	------	------	White pine, red pine, Norway spruce, arborvitae.

² Partial list. Woodland conservationist will supply complete list.
³ Planting is not needed, for trees regenerate naturally.

capacity to provide moisture and an adequate root zone probably are most important. These conditions are determined by the thickness of the surface layer, the texture and consistence of each significant layer, aeration, drainage, depth to the water table, and the natural supply of plant nutrients. Also in table 3 are ratings of hazards to management and lists of trees to favor in the natural stand and trees to use in plantings. Some terms used in table 3 require explanation.

Seedling mortality is the failure of seedlings to grow in a soil after natural seeding or after seedlings have been planted. It is affected by the nature of the soil and by other environmental factors. The ratings for seedling mortality given in this report are for trees in a normal environment. Mortality is *slight* if not more than 25 percent of the planted seedlings die, or if trees ordinarily regenerate naturally in places where there are enough seeds. It is *moderate* if 25 to 50 percent of the seedlings die, or if trees do not regenerate naturally in numbers needed for adequate restocking. In some places replanting to fill open spaces is necessary. Mortality is *severe* if more than 50 percent of the planted seedlings die, or if trees do not ordinarily reseed naturally in places where there are enough seeds. If mortality is severe, plant seedlings where the seeds do not grow, prepare special seedbeds, and use good methods of planting to insure a full stand of trees.

Erosion hazard is rated according to the risk of erosion on well-managed woodland that is not protected by special practices. It is *slight* where only a slight loss of soil is expected. Generally, erosion is slight if slopes range from 0 to 12 percent and runoff is slow or very slow. The erosion hazard is *moderate* if the loss of soil is moderate in places where runoff is not controlled and the vegetative cover is not adequate for protection. It is *severe* if steep slopes, rapid runoff, slow infiltration and permeability, and past erosion make the soil susceptible to severe erosion.

Windthrow hazard depends on the development of roots and on the ability of the soils to hold trees firmly in the soil. The hazard is *slight* if trees are firmly rooted and do not fall over in a normal wind. It is *moderate* if roots hold the trees firmly, except when the soil is excessively wet and the wind is strong. Windthrow hazard is *severe* if roots do not provide enough stability to prevent the trees from blowing over when they are not protected by other trees.

Equipment limitations are rated according to the degree that soils restrict or prevent the use of forestry equipment. Limitations are *slight* if there are no restrictions on the type of equipment or on the time of year that equipment can be used. They are *moderate* if slopes are moderately steep, if heavy equipment is restricted by wetness in winter and early in spring, or if the use of equipment damages the tree roots to some extent. Equipment limitations are *severe* if many types of equipment cannot be used, if the time that equipment cannot be used is more than 3 months a year, and if the use of equipment severely damages the roots of trees and the structure and stability of the soil. Equipment limitations are severe on moderately steep and steep slopes that are stony and have rock outcrops. They are also severe on wet bottom lands and low terraces in winter and early in spring.

WOODLAND SUITABILITY GROUP 1

This group consists of medium-textured, moderately well drained and well drained soils that are generally deep. Slopes range from 0 to 18 percent. Permeability is moderate, and available moisture capacity is generally high. Runoff is slow on the nearly level soils and is medium on the strongly sloping ones. The soils are—

Camden silt loam, 0 to 2 percent slopes.
Camden silt loam, 2 to 6 percent slopes, moderately eroded.
Celina silt loam, 0 to 2 percent slopes.
Celina silt loam, 2 to 6 percent slopes, moderately eroded.
Fox silt loam, 0 to 2 percent slopes.
Fox silt loam, 2 to 6 percent slopes, moderately eroded.
Fox silt loam, 6 to 12 percent slopes, moderately eroded.
Fox silt loam, 12 to 18 percent slopes, moderately eroded.
Fox soils, 6 to 12 percent slopes, severely eroded.
Fox silt loam, till substratum, 0 to 2 percent slopes.
Fox silt loam, till substratum, 2 to 6 percent slopes.
Fox silt loam, till substratum, 2 to 6 percent slopes, moderately eroded.
Fox silt loam, till substratum, 6 to 12 percent slopes.
Fox silt loam, till substratum, 6 to 12 percent slopes, moderately eroded.
Fox soils, till substratum, 2 to 6 percent slopes, severely eroded.
Fox silt loam, limestone substratum, 0 to 2 percent slopes.
Miami silt loam, 0 to 2 percent slopes.
Miami silt loam, 2 to 6 percent slopes, moderately eroded.
Miami silt loam, 6 to 12 percent slopes, moderately eroded.
Miami silt loam, 12 to 18 percent slopes, moderately eroded.
Miami soils, 2 to 6 percent slopes, severely eroded.
Miami soils, 6 to 12 percent slopes, severely eroded.
Miami soils, 12 to 18 percent slopes, severely eroded.
Morley silt loam, 2 to 6 percent slopes, moderately eroded.
Morley silt loam, 6 to 12 percent slopes, moderately eroded.
Morley silt loam, 12 to 18 percent slopes.
Morley soils, 2 to 6 percent slopes, severely eroded.
Morley soils, 6 to 12 percent slopes, severely eroded.
Morley soils, 12 to 18 percent slopes, severely eroded.
Ockley silt loam, 0 to 2 percent slopes.
Ockley silt loam, 2 to 6 percent slopes.

The Fox soils of this group differ from the others in that they are only moderately deep and have moderate instead of high available moisture capacity.

On the soils of this woodland group, seedling mortality is moderate on the steeper slopes and on the south-facing slopes, but it is slight in other places. The lack of good seed trees is a problem in some wooded areas. Because these soils erode rather rapidly, some care should be taken in logging the steeper areas. Immediately following logging, it may be desirable to seed logging trails to grass. The use of forestry equipment is limited only on the steeper slopes. On the steep, eroded slope breaks, logging with conventional farm tractors of the wheel type is dangerous.

According to the Doyle rule, the potential productivity, in board feet per acre per year, in a well-managed, fully stocked stand is 330 to 470 for upland oaks and 410 to 590 for tulip-poplar.

WOODLAND SUITABILITY GROUP 2

This group consists of moderately deep or deep, well-drained soils that have a medium-textured or moderately coarse textured surface layer. Slopes range from 0 to 25 percent. Permeability is moderate, and available moisture capacity is moderate to high. Runoff is slow on nearly level slopes and is rapid on steep ones. The soils are—

Fox fine sandy loam, 0 to 2 percent slopes.
Fox fine sandy loam, 2 to 6 percent slopes.

Hennepin soils, 18 to 35 percent slopes, eroded.
Miami silt loam, 18 to 25 percent slopes, moderately eroded.
Miami soils, 18 to 25 percent slopes, severely eroded.

Seedling mortality is moderate on the steeper slopes, on south-facing slopes, and in severely eroded areas, but it is only slight in other places. The erosion hazard is moderate on the Miami and Hennepin soils and is slight on the Fox soils. Because of the erosion hazard, the location of skid trails and logging trails is important. Conventional farm tractors of the wheel type can be used in logging only on the Fox soils.

According to the Doyle rule, the potential productivity, in board feet per acre per year, in a well-managed, fully stocked stand is 330 to 470 for upland oaks and 475 to 590 for tulip-poplar.

WOODLAND SUITABILITY GROUP 5

This group consists of deep or moderately deep, medium-textured, somewhat poorly drained soils that occur on level plains and on gentle slopes of terraces and uplands. Permeability and runoff are slow, and available moisture capacity is high. The soils are—

Blount silt loam, 0 to 2 percent slopes.
Blount silt loam, 2 to 6 percent slopes, moderately eroded.
Crosby silt loam, 0 to 2 percent slopes.
Crosby silt loam, 2 to 6 percent slopes, moderately eroded.
Homer silt loam.
Homer silt loam, limestone substratum.
Sleeth silt loam.
Sleeth silt loam, loamy substratum.

On these soils seedling mortality and erosion are slight. Because the water table is high, tree roots are shallow and the windthrow hazard is moderate or severe. Late in winter and early in spring, these soils are extremely wet and logging is impractical because the logging equipment damages tree roots and breaks down soil structure.

According to the Doyle rule, the potential productivity, in board feet per acre per year, in a well-managed, fully stocked stand is 350 to 530 for pin oak, 410 to 550 for tulip-poplar, and 270 to 440 for upland oaks.

WOODLAND SUITABILITY GROUP 8

This group consists of deep, moderately coarse textured to moderately fine textured soils that are well drained or moderately well drained. These soils are moderately permeable and have high available moisture capacity. They occur in nearly level areas on flood plains. Runoff is slow, and seasonal flooding is likely. The soils are—

Eel silt loam.
Genesee silt loam.

Most of the wooded areas of these soils are narrow strips bordering the major streams of the county. Hazards to management are few and slight. The seasonal flooding often benefits the establishment and growth of seedlings, for trees like cottonwood, sycamore, and soft maple normally depend on high water for the dispersal of seeds. The high fertility and good moisture content of these soils are favorable for tree growth.

According to the Doyle rule, the potential productivity of tulip-popular is 475 to 590 board feet per acre per year, in a fully stocked, well-managed stand.

WOODLAND SUITABILITY GROUP 11

This group consists of deep or moderately deep, medium-textured or moderately fine textured soils that are very poorly drained or poorly drained. These soils are slowly permeable and have high available moisture capacity. They occur in nearly level and depressional areas where runoff is slow to ponded. The water table is seasonally high. The soils are—

Brookston silt loam.
Brookston silty clay loam.
Kokomo silty clay loam.
Kokomo silty clay loam, gravelly substratum.
Kokomo mucky silty clay loam, gravelly substratum.
Kokomo silty clay loam, stratified substratum.
Kokomo mucky silt loam, stratified substratum.
Mahalasville silt loam.
Mahalasville silty clay loam.
Mahalasville silty clay loam, limestone substratum.
Pewamo silty clay loam.
Sloan silt loam.
Washtenaw complex.
Westland silty clay loam.
Westland silty clay loam, moderately deep.

These soils are often so wet that trees cannot reseed naturally, and at planting time they are nearly always so wet that planting is difficult. Because of ponding and the seasonally high water table, tree roots are shallow and the windthrow hazard is moderate to severe. For more than 3 months of the year, logging is difficult because these soils are extremely wet.

Areas of woodland are normally small and are surrounded by cropland. The trees are in areas that are impractical to drain and to crop.

According to the Doyle rule, the potential productivity, in board feet per acre per year, in a well-managed, fully stocked stand is 350 to 590 for pin oak and 410 to 590 for tulip-poplar.

WOODLAND SUITABILITY GROUP 13

The only soil in this group is Shoals silt loam. This soil is deep, medium textured and moderately fine textured, and somewhat poorly drained. It occurs on bottom lands and is level or depressional. Permeability is slow, available moisture capacity is high, and runoff is slow to ponded. This soil is flooded periodically, and it has a seasonally high water table.

The seedling mortality and erosion hazard are slight. Because the water table is seasonally high, roots do not penetrate the soil deeply and the windthrow hazard is moderate. Late in winter and early in spring, these soils are wet and logging equipment damages the shallow roots and compacts the soil.

According to the Doyle rule, the potential productivity, in board feet per acre per year, in a well-managed, fully stocked stand is 335 to 450 for pin oak and 260 to 335 for sweetgum.

WOODLAND SUITABILITY GROUP 19

Rodman soils, 12 to 50 percent slopes, eroded, are the only soils in this group. These soils are medium textured, shallow, and gravelly. They are well drained and strongly sloping to very steep. Permeability is rapid, available moisture capacity is low, and runoff is medium to rapid.

Equipment limitations are moderate to severe. The short, steep, erosive slopes make logging costly and hazardous. Special logging equipment is often needed for harvesting trees.

According to the Doyle rule, the potential productivity, in board feet per acre per year, in a well-managed, fully stocked stand is 130 to 185 for upland oaks.

WOODLAND SUITABILITY GROUP 23

This group consists of organic soils, mineral soils, and land types that have little or no importance for timber production. The soils and land types are—

Carlisle muck.
Clay pits.
Edwards muck.
Gravel pits.
Linwood muck.
Made land.
Ross silt loam.
Ross loam.
Wallkill complex.

Gravel pits and some areas of Clay pits are filled with water. The overburden taken from these pits is generally spread out and is not a problem.

The soils and land types in this group generally are not suited to trees that produce wood crops, but trees for farmstead windbreaks and field windbreaks can be planted on some of the soils. Each site requires evaluation before trees are planted.

Wildlife Management [3]

The trend in Madison County toward large farms and more intensive cropping has impaired the balance between food, cover, and water that is needed for wildlife. This balance has been particularly impaired on the level Pewamo and Blount soils in the northeastern part of the county, on the level Mahalasville and Sleeth soils on outwash in the northwestern part, and on the Brookston and Crosby soils on the broad, level till plains throughout the rest of the county. These soils make up about 70 percent of the county.

Fences have been removed on many farms so that large farm equipment can be used efficiently on the large fields. Removed with the fences was much of the linear cover that bordered small fields and was valuable as nesting cover, as travel lanes, and as a source of a limited supply of food. Clean tilling the larger fields with large equipment also impaired the balance between food and cover because it reduced the food near cover that small animals, game birds, and songbirds used for nesting and for escape. Although the food supply is abundant in the heavily cropped fields, a lack of cover near the food supply often makes the food unavailable. More year-round cover is needed to make the food easier to obtain. Lanes to the food and lanes for escape can be provided by planting linear cover, such as hedgerows of multiflora rose or autumn olive or field borders of stiff-stemmed herbs. Quail, pheasants, and rabbits need this cover to escape from foxes, hawks, and other predators. In addition, these lanes provide nesting places for game birds and songbirds.

Supplying water for wildlife is only a small problem in the county. Most animals, game birds, and songbirds obtain enough water from dew, rainfall, and succulent vegetation. Other water is available in drainage ditches and intermittent streams.

The intensively cropped northeastern part of the county has the heaviest population of quail, pheasants, and rabbits. In this area the acreage of level to gently sloping Pewamo, Blount, and Morley soils is large.

Hayfields and meadows are more plentiful on the Morley, Celina, and Miami soils in gently rolling areas along small drainageways and on low ridges. In these areas contour cultivation, grassing the waterways, and other conservation practices are needed for erosion control. If the waterways are properly managed, they provide excellent cover for escape and for nesting. Field border strips and grassy fence rows are excellent cover for small animals and birds. Beneficial insects also live in these places.

The Miami and Fox soils occur in gently rolling to strongly rolling areas that parallel the major streams and drainageways in the county. The Hennepin soils on steep slopes are generally wooded and are inhabited by foxes and gray squirrels. Miami, Fox, and Hennepin are closely associated soils and occupy about 20 percent of the county. They occur in areas where grass and woody cover are abundant, but where there is less farming for grain. Food for wildlife is scarce because more grass and legumes are grown. To supply enough food, a few patches of grain should be planted, and areas in grain aftermath should be managed to provide ragweed and other desirable food. These practices also benefit game birds and songbirds. Also important is managing these areas so that adequate cover is provided. Sodded waterways provide cover for nesting and escape. Protection from grazing is needed on woodland if it is to be a good habitat for squirrels.

The soils on bottom lands and outwash in the valleys of major streams occupy about 10 percent of Madison County. The Eel, Genesee, Shoals, Sloan, and Ross soils are on the bottom lands along the streams. Areas of these soils have a cover of cottonwood, willow, soft maple, and similar trees. The brushy cover in these areas protects small game and birds. Areas above the streams provide abundant food in the form of waste grain from the harvested crop. More row crops and small grain are grown on the Fox, Camden, Ockley, Kokomo, Westland, and Sleeth soils, which are on outwash. The steep Rodman soils are mostly wooded. In areas of these soils the number of birds can be increased by improving their nesting cover through the use of more grass and legumes. The grass and legumes can be grown in border strips along wooded areas and in odd areas. Small game use brushy plantings, and areas in grass and legumes, for travel lanes and escape cover.

The number of deer in Madison County is small because 85 percent of the county is in farms and urbanization has increased.

Hunting on private land has increased near Anderson and in Muncie, Indianapolis, and other population centers outside of the county. The pressure of this increase is great because there are no areas for public or commercial hunting near the population centers. If areas for hunting were developed, the income of the county could be increased. Other income could be provided by making recreation areas out of the gravel pits and by constructing ponds and small lakes for fishing and other recreation.

Engineering Properties of Soils [4]

This subsection (1) gives the engineering uses that can be made of the information in this report; (2) briefly

[3] By M. M. MERRITT, State soil conservationist, Soil Conservation Service.

[4] Prepared with the assistance of ZEB ALDRIDGE, area engineer, Soil Conservation Service.

describes the two systems of classification generally used by engineers; (3) gives test data obtained when selected soils were tested to determine their engineering properties; (4) lists and interprets properties of the soils that are important to engineering; and (5) discusses uses of soils as disposal fields for septic tanks and as building sites.

The properties of soils that are important to engineers are grain size, permeability, reaction, frost potential, shrink-swell characteristics, seasonal variations in the water table, and depth to bedrock. The topographic position of the soils may also be significant. Compaction characteristics, strength against shearing, stability, and other characteristics also need to be considered.

With the use of the soil map for identification, the engineering interpretations in this subsection can be useful for many purposes. It should be emphasized that they may not eliminate the need for sampling and testing at the site of specific engineering works where heavy loads are to be supported and where the excavations are deeper than the depth of layers reported. Even in these situations, the soil map is useful for planning more detailed field investigations and for suggesting the kinds of problems that may be expected.

The information in this report can be used to—

1. Make studies of soil and land use that will aid in selecting and developing industrial, business, residential, and recreational sites.
2. Make preliminary evaluations of soil and ground conditions that will aid in selecting highway and airport locations and in planning detailed soil investigations of the selected locations.
3. Assist in designing drainage systems, farm ponds, diversion terraces, and other structures for soil and water conservation.
4. Locate possible sources of sand and gravel.
5. Correlate performance of structures with soil mapping units and, thus, develop information that is useful in designing and maintaining new structures.
6. Determine the suitability of soil units for cross-country movements of vehicles and construction equipment.
7. Supplement information obtained from other published maps and reports and aerial photographs for the purpose of making maps and reports that can be used readily by engineers.
8. Develop other preliminary estimates for construction purposes pertinent to the particular area.

Some terms used by the soil scientist may be unfamiliar to the engineer, and some terms have a special meaning in soil science. Most of these terms, as well as other special terms used in this report, are defined in the Glossary. Information useful for engineering can be obtained from the soil map and from other parts of this report, particularly the sections "Descriptions of the Soils" and "Formation and Classification of Soils."

Much of the information in this section is in tables. The data in table 4 are from laboratory tests, and the estimates for the soils listed in tables 5 and 6 were made by comparing those soils with the soils tested. At many construction sites variations in the soils may be present within the depth of the proposed excavations, and several soils may occur within short distances. For these reasons laboratory data on engineering properties of the soil at the construction site should be obtained before engineering work is planned in detail.

TABLE 4.—*Engineering test data for soil samples*

[Tests performed by Purdue University in cooperation with the Indiana State Highway Dept. and the Bureau of Public Roads (BPR). Association of State

Soil name and location	Parent material	SCS report No.	Depth	Horizon	Moisture-density[1]: Maximum dry density	Moisture-density[1]: Optimum moisture	CBR test[2]: Molded specimen: Dry density	CBR test[2]: Molded specimen: Moisture content	CBR test[2]: CBR	CBR test[2]: Swell
		S61 Ind-48-	*Inches*		*Lb. per cu. ft.*	*Percent*	*Lb. per cu. ft.*	*Pct.*	*Pct.*	*Pct.*
Brookston silty clay loam: SE¼NE¼ sec. 23, T. 18 N., R. 6 E. (modal).	Late Wisconsin glacial till.	7-1	0-9	Ap	101	18	101. 5	18. 4	6	1. 18
		7-2	18-28	B22g	102	21	102. 0	20. 8	5	. 44
		7-3	50-60+	C2g	119	14	118. 8	13. 4	3	—. 22
SE¼SE¼ sec. 25, T. 19 N., R. 7 E. (approaching Kokomo).	Late Wisconsin glacial till.	8-1	0-10	Ap	99	20	99. 4	20. 1	6	. 47
		8-2	21-33	B22g	105	17	104. 5	17. 1	6	1. 34
		8-3	44-60	C2g	117	15	116. 4	15. 4	4	--------
SW¼SW¼ sec. 13, T. 21 N., R. 6 E. (approaching Mahalasville).	Lacustrine silt and sand over glacial till.	9-1	0-9	Ap	98	22	98. 7	21. 0	6	. 82
		9-2	17-28	B22g	101	20	102. 0	20. 3	8	. 80
		9-3	44-60	C2g	125	11	122. 7	11. 6	7	. 3
Fox silt loam: SE¼NW¼ sec. 11, T. 20 N., R. 6 E. (modal).	Glacial outwash.	2-1	3-11	A2	109	16	109. 2	16. 3	10	—. 07
		2-2	21-29	B22	104	17	106. 0	17. 7	13	. 4
		2-3	29-36	B3	108	13	106. 3	15. 5	12	. 65
		2-4	36-50+	C	132	10	131. 0	9. 5	37	—. 36
NW¼NW¼ sec. 35, T. 19 N., R. 7 E. (approaching Casco).	Glacial outwash.	3-1	2-9	A2	108	16	109. 2	16. 1	9	. 16
		3-2	14-20	B22	101	20	101. 4	21. 2	6	. 27
		3-3	20-26	B3	100	18	98. 5	17. 3	4	2. 76
		3-4	35-50+	C2	136	8	134. 2	7. 7	70	0
SW¼NW¼ sec. 16, T. 19 N., R. 8 E. (approaching Ockley).	Glacial outwash.	1-1	3-11	A2	103	18	103. 0	18. 1	5	. 20
		1-2	23-34	B22	110	16	110. 1	16. 9	5	. 11
		1-3	34-41	B3	108	16	107. 9	15. 8	14	. 24
		1-4	41-60+	C	127	11	126. 6	11. 2	20	0
Miami silt loam: SE¼NW¼ sec. 23, T. 20 N., R. 6 E. (modal).	Late Wisconsin glacial till.	6-1	3-11	A2	98	21	97. 1	22. 0	2	. 16
		6-2	23-34	B22	105	19	104. 3	19. 6	5	. 2
		6-3	37-52+	C	118	14	118. 1	14. 8	5	. 22
SW¼NE¼ sec. 17, T. 18 N., R. 8 E. (approaching Fox).	Late Wisconsin glacial till.	4-1	4-11	A2	98	22	97. 6	22. 4	2	—. 11
		4-2	19-27	B22	103	20	102. 3	20. 9	6	. 22
		4-3	39-52+	C2	122	12	121. 0	12. 2	5	. 13
NW¼NW¼ sec. 6, T. 19 N., R. 7 E. (approaching Hennepin).	Late Wisconsin glacial till.	5-1	3-8	A2	106	17	107. 0	17. 6	3	—. 29
		5-2	15-24	B22	104	18	104. 5	19. 2	6	. 49
		5-3	30-45+	C2	124	12	123. 2	12. 3	3	. 49

[1] Based on AASHO Designation: T 99-57, Method A (*1*).

[2] The soil sample is prepared according to method described in AASHO Designation: T 87-49. Water is added to bring moisture content to within ±0.5 percent of optimum. Specimens are compacted according to Method B described in AASHO Designation: T 99-57 to within ±1 lb. per cu. ft. of maximum dry density. A surcharge of 35 lb. is added, and the specimen is soaked from top and bottom for 4 days. The penetration is performed at a rate of 0.05 in. per min. while the 35-lb. surcharge is on the specimen. The CBR value is for 0.1 inch penetration.

[3] Mechanical analyses according to the AASHO Designation: T 88-57 (*1*). Results by this procedure may differ somewhat from results obtained by the soil survey procedure of the Soil Conservation Service (SCS). In the AASHO procedure, the fine material is analyzed by the hydrometer method, and the various grain-size fractions are calculated on the basis of all the material, including that

taken from nine soil profiles, Madison County, Ind.

Except for determining the California bearing ratio (CBR), tests were performed in accordance with standard procedures of the American Highway Officials (AASHO)]

Mechanical analysis [3]													Liquid limit	Plasticity index	Classification	
Percentage passing sieve—									Percentage smaller than—						AASHO	Unified [4]
3 in.	1½ in.	1 in.	¾ in.	⅜ in.	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)	0.05 mm.	0.02 mm.	0.005 mm.	0.002 mm.				
-----	-----	-----	-----	-----	100	99	96	81	78	65	39	30	44	18	A-7-6(12)	ML-CL.
-----	-----	-----	-----	-----	100	99	96	85	82	73	47	39	50	29	A-7-6(18)	CL.
-----	-----	100	98	97	94	88	81	64	60	49	29	24	28	12	A-6(7)	CL.
-----	-----	-----	-----	-----	100	99	95	79	75	61	36	25	40	15	A-6(10)	ML-CL.
-----	-----	-----	-----	100	99	99	96	87	83	70	46	37	46	24	A-7-6(15)	CL.
-----	-----	-----	100	99	97	93	88	66	60	51	35	27	29	13	A-6(7)	CL.
-----	-----	-----	-----	-----	-----	100	99	94	92	75	44	35	52	23	A-7-6(13)	MH-CH or CH.
-----	-----	-----	-----	-----	-----	100	98	96	94	81	49	41	58	35	A-7-6(20)	CH.
-----	-----	100	98	95	90	86	77	54	51	40	23	19	23	7	A-4(4)	ML-CL.
-----	-----	-----	-----	100	99	98	88	69	65	51	24	16	28	6	A-4(7)	ML-CL.
-----	-----	100	96	88	83	76	57	48	48	45	35	30	48	21	A-7-6(7)	SM-SC.
-----	-----	-----	100	86	73	63	43	27	27	25	25	24	46	20	A-2-7(1)	SM-SC.
-----	-----	100	95	80	68	55	20	6	5	5	4	4	[5] NP	[5] NP	A-1-b(0)	SW-SM.
-----	-----	-----	100	94	89	84	78	68	67	55	27	20	39	15	A-6(9)	ML-CL.
-----	-----	100	80	73	67	53	44	38	38	37	30	28	34	5	A-4(1)	GM.
-----	-----	100	88	78	71	64	55	50	50	46	38	35	52	22	A-7-6(8)	SM-SC.
[6] 97	97	87	83	73	55	26	7	5	5	5	3	2	19	4	A-1-a(0)	SW-SM.
-----	-----	-----	-----	-----	-----	100	96	82	74	54	24	15	32	10	A-4(8)	ML-CL.
-----	-----	-----	100	99	95	90	75	58	55	47	39	36	36	16	A-6(7)	CL.
-----	-----	100	84	73	64	53	35	26	25	25	23	20	47	19	A-2-7(1)	SM-SC.
-----	[7] 100	81	75	63	50	28	8	5	5	4	3	2	[5] NP	[5] NP	A-1-a-(0)	GW-GM.
-----	-----	-----	-----	-----	100	99	96	81	77	50	21	15	33	8	A-4(8)	ML-CL.
-----	-----	-----	100	99	99	97	94	76	73	63	47	39	37	18	A-6(11)	CL.
-----	-----	100	98	97	94	89	87	64	63	53	35	25	30	14	A-6(7)	CL.
-----	-----	-----	-----	-----	100	99	94	85	85	68	33	25	37	11	A-6(8)	ML-CL.
-----	-----	100	98	95	92	89	78	60	57	53	43	41	53	31	A-7-6(15)	CH.
-----	-----	100	96	94	91	87	77	60	59	50	30	24	25	10	A-4(5)	CL.
-----	-----	-----	-----	100	99	98	92	71	71	60	29	23	26	5	A-4-(7)	ML-CL.
-----	-----	-----	-----	100	99	97	93	73	71	68	52	43	46	26	A-7-6(15)	CL.
-----	-----	-----	100	93	88	83	76	56	53	44	25	19	23	8	A-4(4)	CL.

coarser than 2 millimeters in diameter. In the SCS soil survey procedure, the fine material is analyzed by the pipette method and the material coarser than 2 millimeters in diameter is excluded from calculations of grain-size fractions. The mechanical analyses used in this table are not suitable for use in naming textural classes for soil.

[4] SCS and BPR have agreed to consider that all soils having plasticity indexes within two points of the A-line are to be given a border line classification. Examples are MH-CH, ML-CL, SM-SC.

[5] NP=Nonplastic.

[6] An estimated 3 percent was larger than 3 inches and was discarded in field sampling.

[7] Based on sample as received in laboratory. Laboratory test data not corrected for amount discarded in field sampling.

TABLE 5.—*Brief description of soils of Madison County,*

Map symbol	Soil	Description of soil and site	Depth from surface	Classification: USDA texture
			Inches	
BoA BoB2	Blount silt loam, 0 to 2 percent slopes. Blount silt loam, 2 to 6 percent slopes, moderately eroded.	Somewhat poorly drained, deep soils on uplands that consist of 0 to 18 inches of loess over silty clay loam and loam and a clay loam till; friable, granular to platy silt loam surface layer and subangular blocky silty clay loam or silty clay subsoil; calcareous till at depth of 20 to 40 inches; water table seasonally at depth of 1 to 3 feet.	0–9 9–26 26–35	Silt loam Silty clay loam or silty clay. Silty clay loam or clay loam.
Br Bs	Brookston silt loam. Brookston silty clay loam.	Very poorly drained, deep, nearly level soils in upland depressions; friable, granular silty clay loam or silt loam surface layer and firm, prismatic to angular blocky silty clay loam subsoil; calcareous loam to light clay loam till at depth of 49 inches or more; depth to parent material ranges from 42 to 60 inches; flooding and ponding common; water table at or near surface in wet periods.	0–15 15–49 49–59	Silt loam or silty clay loam. Silty clay loam Loam
CaA CaB2	Camden silt loam, 0 to 2 percent slopes. Camden silt loam, 2 to 6 percent slopes, moderately eroded.	Well-drained, deep, nearly level to gently sloping soils on outwash plains; friable, granular silt loam surface layer and firm, medium, prismatic to medium, angular blocky heavy silt loam, silty clay loam, or clay loam subsoil; depth to parent material of calcareous, stratified silt and sand, with some gravel and clay, is generally at 44 inches, but depth ranges from 42 to 60 inches or more; in southern part of county, till occurs at depth of 55 to 60 inches; slopes are stable; water table is seasonally deep.	0–12 12–44 44–66	Silt loam Silty clay loam or clay loam. Silt loam, fine sand, or silt.
Cm	Carlisle muck.	Very poorly drained, deep, nearly level or depressional organic soil; friable, granular muck extends to depth of about 28 inches and is mixed with peat below; flooding and ponding common; water table at or near surface during wet periods.	0–28 28–50	Muck Muck and peat
CnA CnB2	Celina silt loam, 0 to 2 percent slopes. Celina silt loam, 2 to 6 percent slopes, moderately eroded.	Moderately well drained, deep, nearly level to gently sloping soils that occur on uplands and consist of 0 to 18 inches of loess over loam, silt loam, or light clay loam till; friable, granular silt loam surface layer and firm, subangular blocky silty clay loam or clay loam subsoil; highly calcareous till at depth of 24 to 42 inches; slopes stable; water table seasonally at about 3 feet.	0–9 9–27 27–42	Silt loam Silty clay loam or clay loam. Loam
CrA CrB2	Crosby silt loam, 0 to 2 percent slopes. Crosby silt loam, 2 to 6 percent slopes, moderately eroded.	Somewhat poorly drained, deep, nearly level to gently sloping soils on uplands that consist of 0 to 18 inches of loess over loam, silt loam, or light clay loam till; friable, granular silt loam surface layer and prismatic to firm, subangular blocky silty clay loam or clay loam subsoil; highly calcareous till at depth of 24 to 42 inches; slopes stable; water table seasonally at depth of 1 to 3 feet.	0–10 10–34 34–42	Silt loam Silty clay loam or clay loam. Loam or clay loam
Ed	Edwards muck.	Very poorly drained, moderately deep, nearly level or depressional organic soil; organic layer is underlain by highly calcareous marl at depth of 12 to 42 inches; flooding common; water table is at or near the surface during wet periods.	0–24 24–34	Muck and peat Marl
Es	Eel silt loam.	Moderately well drained, deep soil on bottom lands; friable, granular silt loam surface layer underlain by friable, subangular blocky silt loam to massive loam or silt loam containing thin layers of sand in some places; neutral to alkaline in upper layers, calcareous at depth of about 3 feet; flooding common; water table at about 3 feet during dry periods.	0–10 10–42	Silt loam Silt loam, loam, or fine sandy loam.
FaA	Fox fine sandy loam, 0 to 2 percent slopes.	Well-drained, moderately deep, nearly level to strongly sloping soils formed from outwash material; friable,	0–12	Silt loam or fine sandy loam.

See footnotes at end of table.

Indiana, and their estimated properties

Classification—Continued		Percentage passing sieve—			Permeability	Available water capacity	Reaction	Frost potential	Shrink-swell pote
Unified	AASHO	No. 10	No. 40	No. 200					
					Inches per hour	*Inches per inch of soil*	*pH*		
ML	A-4	100	90–100	85–95	0. 8–2. 5	0. 20	6. 1–6. 5	Moderate	Low.
CL or CH	A-7	100	95–100	80–95	0. 05–0. 2	. 17	5. 6–6. 0	Moderate	Moderate or high.
CL	A-6 or A-7	100	90–100	75–90	0. 2–0. 8	. 18	(1)	Moderate	Moderate.
CL	A-6	100	95–100	80–90	0. 2–0. 8	. 22	6. 6–7. 3	Moderate	Moderate.
CL or CH	A-7	100	95–100	75–85	0. 2–0. 8	. 19	6. 6–7. 3	Moderate	Moderate.
ML or CL	A-4 or A-6	95–100	80–90	60–70	0. 2–0. 8	. 16	(1)	Moderate	Low or moderate.
ML	A-4	100	95–100	80–90	0. 8–2. 5	. 20	5. 6–6. 0	High	Low.
CL	A-4 or A-6	95–100	90–100	80–95	0. 8–2. 5	. 17	5. 1–6. 0	High	Low or moderate.
ML	A-4	90–100	60–70	50–60	0. 8–2. 5	. 15	6. 6–7. 3	High	Low.
OL					2. 5–5. 0	>. 25		Low	Low.
Pt									
ML	A-4	100	90–100	85–95	0. 8–2. 5	. 21	5. 6–6. 5	Moderate or high.	Low.
CL	A-6 or A-7	95–100	90–100	85–95	0. 2–0. 8	. 17	5. 6–6. 0	Moderate	Moderate or high.
ML or CL	A-4 or A-6	95–100	60–70	60–70	0. 2–0. 8	. 16	(1)	Moderate	Low.
ML or CL	A-4	100	90–100	85–95	0. 8–2. 5	. 21	5. 6–6. 0	Moderate or high.	Low or moderate.
CL	A-6	95–100	95–100	75–85	0. 2–0. 8	. 19	5. 6–6. 0	Moderate	Moderate.
ML or CL	A-4 or A-6	95–100	85–95	60–70	0. 8–2. 5	. 15	(1)	Moderate	Low or moderate.
Pt					2. 5–5. 0	>. 25	6. 6–7. 3	Low	Low.
					Variable	Variable	(1)	Low	Low.
ML	A-4	95–100	90–100	80–90	0. 8–2. 5	. 21	6. 6–7. 3	Moderate or high.	Low or moderate.
ML	A-4	95–100	70–80	50–60	0. 8–2. 5	. 17	6. 6–7. 3	Moderate	Low.
ML or SM	A-4	95–100	80–90	65–75	0. 8–2. 5	. 17	6. 1–6. 5	Moderate	Low.

TABLE 5.—*Brief description of soils of Madison County,*

Map symbol	Soil	Description of soil and site	Depth from surface	Classification: USDA texture
			Inches	
FaB FoA FoB2 FoC2 FoD2 FtC3	Fox fine sandy loam, 2 to 6 percent slopes. Fox silt loam, 0 to 2 percent slopes. Fox silt loam, 2 to 6 percent slopes, moderately eroded. Fox silt loam, 6 to 12 percent slopes, moderately eroded. Fox silt loam, 12 to 18 percent slopes, moderately eroded. Fox soils, 6 to 12 percent slopes, severely eroded.	granular silt loam or fine sandy loam surface layer and firm, subangular blocky light silty clay loam, clay loam, or sandy clay loam subsoil; stratified, calcareous sand and gravel at depth of 24 to 42 inches or more; slopes stable; soils tend to be droughty; water table seasonally deep; in the severely eroded soil nearly all, and in some places all, of the original surface layer has been lost through erosion.	12–36 36–44	Silty clay loam, clay loam, or sandy clay loam. Sand and gravel
FrA	Fox silt loam, limestone substratum, 0 to 2 percent slopes.	Well-drained, moderately deep, nearly level soil formed from glacial drift over limestone; friable; granular silt loam surface layer and firm, subangular silty clay loam subsoil; limestone at depth of 28 inches; bedrock at depth of 18 to 42 inches or more; slopes stable; water table seasonally deep.	0–12 12–28 (2)	Silt loam Silty clay loam Limestone
FsA FsB FsB2 FsC FsC2 FxB3	Fox silt loam, till substratum, 0 to 2 percent slopes. Fox silt loam, till substratum, 2 to 6 percent slopes. Fox silt loam, till substratum, 2 to 6 percent slopes, moderately eroded. Fox silt loam, till substratum, 6 to 12 percent slopes. Fox silt loam, till substratum, 6 to 12 percent slopes, moderately eroded. Fox soils, till substratum, 2 to 6 percent slopes, severely eroded.	Well-drained, deep, nearly level to sloping soils formed from outwash material underlain by calcareous till; friable, granular silt loam surface layer and firm, subangular blocky clay loam or sandy clay loam subsoil that may be underlain by 0 to 6 inches of sand and gravel that, in turn, is underlain by calcareous loam, silt loam, or light clay loam till; slopes stable; water table seasonally deep; in the severely eroded areas nearly all, and in some places all of the original surface layer has been lost through erosion.	0–9 9–30 30–36 36–40	Silt loam Silt loam, clay loam, or sandy clay loam. Sand and gravel Loam to clay loam
Gn	Genesee silt loam.	Well-drained deep soil on bottom lands; friable, granular silt loam surface layer underlain by friable, weak, subangular blocky silt loam; layers of loam, fine sandy loam, and fine sand occur, especially in the C horizon; periodic overflow; water table at about 3 feet or more in dry periods.	0–8 8–42	Silt loam Silt loam, loam, fine sandy loam, or fine sand.
HeF2	Hennepin soils, 18 to 35 percent slopes, eroded.	Well-drained, deep, strongly sloping to extremely steep soils on uplands; shallow surface layer of friable silt loam or loam may be underlain by a light silty clay loam subsoil about 4 to 6 inches thick; parent material is calcareous loam, silt loam, or light clay loam; slopes stable; in some areas large boulders are common on the surface; water table seasonally deep.	0–5 5–30	Loam or silt loam Loam to clay loam
Hm	Homer silt loam.	Somewhat poorly drained, moderately deep, nearly level soil formed in outwash material; friable, granular silt loam surface layer and firm, subangular blocky silty clay loam to gravelly clay loam subsoil underlain by well-stratified, calcareous sand and gravel at depth of 24 to 42 inches or more; slope stable; water table seasonally at depth of 1 to 3 feet.	0–10 10–36 36–48	Silt loam Silty clay loam to gravelly clay loam. Sand and gravel
Hn	Homer silt loam, limestone substratum.	Somewhat poorly drained, moderately deep, nearly level soil formed from glacial drift over limestone; friable, granular silt loam surface layer and firm, subangular blocky clay loam to gravelly clay loam subsoil; a few inches of silt may be above the limestone, which occurs at depth of 36 inches; depth to bedrock ranges from 18 to 42 inches; slopes stable; water table seasonally at depth of 1 to 3 feet.	0–15 15–32 32–36 (2)	Silt loam Clay loam Silt Limestone

See footnotes at end of table.

Indiana, and their estimated properties—Continued

Classification—Continued		Percentage passing sieve—			Permeability	Available water capacity	Reaction	Frost potential	Shrink-swell potential
Unified	AASHO	No. 10	No. 40	No. 200					
					Inches per hour	*Inches per inch of soil*	*pH*		
SC or CL	A-6 or A-7	95–100	50–60	35–70	0. 2–2. 5	0. 17	5. 6–6. 0	Moderate	Moderate.
GP or SP-SM	A-1	45–55	10–20	0–10	10+	. 03	(1)	Low	Low.
ML	A-4	100	95–100	85–95	0. 8–2. 5	. 21	6. 6–7. 3	Moderate or high.	Low.
CL or CH	A-6 or A-7	95–100	95–100	85–95	0. 2–0. 8	. 19	6. 6–7. 3	Moderate	Moderate.
ML or CL	A-4	100	95–100	80–95	0. 8–2. 5	. 21	6. 1–6. 5	Moderate or high.	Low.
CL	A-6	95–100	65–75	60–70	0. 8–2. 5	. 19	5. 6–6. 0	Moderate	Moderate.
GM	A-1 or A-2	35–45	10–20	10–15	5. 0–10. 0	. 06	6. 6–7. 3	Low	Low.
CL	A-6	95–100	85–95	65–75	0. 2–0. 8	. 16	(1)	Moderate	Low or moderate.
ML or CL	A-4	100	90–100	75–85	0. 8–2. 5	. 20	6. 6–7. 3	Moderate or high.	Low.
ML	A-4	95–100	85–95	75–90	0. 8–2. 5	. 18	6. 6–7. 3+	Moderate or high.	Low.
ML	A-4	95–100	85–95	60–75	0. 8–2. 5	. 17	6. 1–6. 5	Moderate or high.	Low.
ML or CL	A-4 or A-6	95–100	90–100	60–75	0. 2–0. 8	. 15	(1)	Moderate or high.	Low or moderate.
ML or CL	A-4	100	90–100	85–90	0. 8–2. 5	. 21	6. 6–7. 3	High	Low.
CL	A-6	95–100	70–80	80–90	0. 2–0. 8	. 17	5. 6–6. 0	Moderate	Moderate.
GP or SP-SM.	A-1	25–35	5–10	0–10	10+	. 03	(1)	Low	Low.
ML or CL	A-4	100	90–100	80–95	0. 8–2. 5	. 21	5. 6–6. 0	High	Low.
CL	A-6	95–100	90–100	65–90	0. 2–0. 8	. 17	6. 1–6. 5	Moderate	Moderate.
ML	A-4	100	90–100	75–85	0. 2–0. 8	. 17	(1)	High	Low.

TABLE 5.—*Brief description of soils of Madison County*

Map symbol	Soil	Description of soil and site	Depth from surface	Classification
				USDA texture
			Inches	
Kc	Kokomo silty clay loam.	Very poorly drained, deep, nearly level to depressional soil on uplands; surface layer is generally friable, granular silty clay loam, but in some small areas it consists of silt or as much as 12 inches of muck; subsoil is firm, prismatic, angular or subangular blocky silty clay loam; calcareous loam, silt loam, or light clay loam till at depth of 46 inches; depth to parent material ranges from 42 to 70 inches or more; flooding and ponding common; water table seasonally at or near the surface.	0–19 19–46 46–56	Silty clay loam Clay loam, silty clay loam, or silty clay. Loam to clay loam
Kg Kt	Kokomo silty clay loam, gravelly substratum. Kokomo mucky silty clay loam, gravelly substratum.	Very poorly drained, deep, nearly level to depressional soils formed from outwash material; surface layer is generally friable, granular silty clay loam, but in some places it consists of as much as 12 inches of muck; subsoil is firm, angular to subangular blocky silty clay loam; depth to calcareous sand and gravel is generally 51 inches but ranges from 42 to 70 inches or more; ponding common; water table seasonally at or near the surface.	0–20 20–51 51–55	Silty clay loam Silty clay loam or clay loam Sand and gravel
Km Ks	Kokomo silty clay loam, stratified substratum. Kokomo mucky silt loam, stratified substratum.	Very poorly drained, deep, nearly level to depressional soils formed from outwash material; surface layer is generally friable, granular silty clay loam, but in some places it consists of as much as 12 inches of muck; subsoil is coarse, prismatic to firm, medium, angular blocky silty clay loam; calcareous silt and sand with small amount of gravel and clayey material generally at depth of 49 inches, but depth ranges from 42 to 60 inches or more; flooding and ponding common; water table seasonally at or near the surface.	0–21 21–49 49–56	Silty clay loam Silty clay loam Stratified sand and silt.
Lm	Linwood muck.	Very poorly drained, moderately deep, nearly level to depressional organic soil; friable, granular muck extends to depth of 12 to 42 inches; muck is underlain by calcareous loam or silt loam that may contain pockets of sand and gravel at a depth of below 42 inches; flooding and ponding common; water table at or near the surface during wet periods.	0–20 20–45 45–52	Muck Loam or silt loam Sand and gravel
Mh Ml	Mahalasville silt loam. Mahalasville silty clay loam.	Very poorly drained, deep, nearly level to depressional soils that formed from outwash material; friable, granular silty clay loam or silt loam surface layer and firm, prismatic to angular blocky silty clay loam, silty clay, or clay loam subsoil; depth to underlying calcareous silt and sand ranges from 42 to 60 inches or more; small amount of gravel and clayey material at depth of 44 inches; in a few areas limestone bedrock may occur at a depth of 42 to 60 inches; flooding and ponding common; water table seasonally at or near the surface.	0–12 12–44 44–50	Silty clay loam or silt loam. Silty clay loam to clay loam. Silt and sand
Mm	Mahalasville silty clay loam, limestone substratum.	Very poorly drained, moderately deep, nearly level to depressional soil formed from glacial drift over limestone; friable, granular silty clay loam surface layer and firm, subangular blocky silty clay loam to massive loam subsoil; depth to limestone bedrock is generally 33 inches, but ranges from 18 to 42 inches or more; ponding common during wet periods; water table seasonally at or near the surface.	0–13 13–33 (2)	Silty clay loam Silty clay loam to loam. Limestone bedrock

See footnotes at end of table.

Indiana, and their estimated properties—Continued

Classification—Continued		Percentage passing sieve—			Permeability	Available water capacity	Reaction	Frost potential	Shrink-swell potential
Unified	AASHO	No. 10	No. 40	No. 200					
					Inches per hour	*Inches per inch of soil*	*pH*		
CL	A-6	100	95-100	85-95	0. 2-0. 8	0. 22	6. 6-7. 3	Moderate	Moderate.
CL or CH	A-7	100	95-100	75-90	0. 2-0. 8	. 19	6. 6-7. 3	Moderate	Moderate.
ML or CL	A-4 or A-6	95-100	85-90	55-70	0. 2-0. 8	. 16	(1)	Moderate	Low or moderate.
CL	A-6	100	95-100	85-95	0. 2-0. 8	. 23	6. 6-7. 0	Moderate	Moderate.
CL	A-6	100	90-100	80-90	0. 05-0. 2	. 20	6. 6-7. 3	Moderate	Moderate.
GP or SP-SM	A-1	25-35	5-10	0-10	10+	. 03	(1)	Low	Low.
CL or OL	A-6	95-100	90-100	80-95	0. 2-0. 8	. 23	6. 6-7. 3	Moderate	Moderate.
CL or CH	A-6 or A-7	95-100	90-100	80-95	0. 05-0. 8	. 19	6. 6-7. 3	Moderate	Moderate or high.
ML	A-4	95-100	80-90	85-100	0. 8-2. 5	. 16	(1)	Moderate or high.	Low.
Pt					5. 0-10. 0	>. 25	5. 6-6. 0	Moderate	Low.
ML or CL	A-4 or A-6	95-100	90-100	75-90	0. 8-2. 5	. 19	6. 6-7. 3	Moderate or high.	Low or moderate.
GP or SP-SM	A-1	25-35	5-10	0-10	10+	. 03	(1)	Low	Low.
ML or CL	A-6	95-100	90-100	80-90	0. 2-0. 8	. 20	6. 6-7. 3	Moderate	Moderate.
CL	A-6 or A-7	95-100	95-100	80-95	0. 2-0. 8	. 18	6. 6-7. 3	Moderate	Moderate or high.
ML	A-4	95-100	80-90	65-95	0. 8-2. 5	. 15	(1)	Moderate or high.	Low.
CL or OH	A-6	95-100	95-100	85-95	0. 2-0. 8	. 22	6. 6-7. 3	Moderate	Moderate.
CL or CH	A-6 or A-7	95-100	80-90	85-95	0. 05-0. 2	. 19	6. 6-8. 4	Moderate	Moderate or high.

TABLE 5.—*Brief description of soils of Madison County,*

Map symbol	Soil	Description of soil and site	Depth from surface	Classification: USDA texture
			Inches	
MnA	Miami silt loam, 0 to 2 percent slopes.	Well-drained, deep, nearly level to steep soils on uplands; friable, granular silt loam surface layer and friable to firm clay loam or silty clay loam subsoil; parent material of calcareous loam, silt loam, or light clay loam till is generally at depth of 26 inches, but depth ranges from 24 to 42 inches or more; areas with slopes of 0 to 2 percent are underlain by sand and gravel at depth of 10 feet or more; severely eroded areas have lost nearly all, and in some places all, of their original surface layer through erosion; slopes stable; water table seasonally deep.	0–10	Silt loam
MnB2	Miami silt loam, 2 to 6 percent slopes, moderately eroded.		10–26	Silty clay loam or clay loam.
MnC2	Miami silt loam, 6 to 12 percent slopes, moderately eroded.		26–36	Loam to clay loam
MnD2	Miami silt loam, 12 to 18 percent slopes, moderately eroded.			
MnE2	Miami silt loam, 18 to 25 percent slopes, moderately eroded.			
MpB3	Miami soils, 2 to 6 percent slopes, severely eroded.			
MpC3	Miami soils, 6 to 12 percent slopes, severely eroded.			
MpD3	Miami soils, 12 to 18 percent slopes, severely eroded.			
MpE3	Miami soils, 18 to 25 percent slopes, severely eroded.			
MrB2	Morley silt loam, 2 to 6 percent slopes, moderately eroded.	Well drained to moderately well drained, deep, gently sloping to strongly sloping soils on uplands that consist of 0 to 18 inches of loess over silty clay loam to clay loam till; friable, granular silt loam surface layer and firm, angular blocky silty clay loam to silty clay subsoil; calcareous till generally at depth of 26 inches, but depth ranges from 20 to 40 inches; severely eroded areas have lost nearly all, and in some places all, of their original surface layer through erosion; slopes stable; water table seasonally at depth of 2 to 3 feet.	0–7	Silt loam
MrC2	Morley silt loam, 6 to 12 percent slopes, moderately eroded.		7–26	Silty clay loam to silty clay.
MrD	Morley silt loam, 12 to 18 percent slopes.		26–36	Silty clay loam to clay loam.
MsB3	Morley soils, 2 to 6 percent slopes, severely eroded.			
MsC3	Morley soils, 6 to 12 percent slopes, severely eroded.			
MsD3	Morley soils, 12 to 18 percent slopes, severely eroded.			
OcA	Ockley silt loam, 0 to 2 percent slopes.	Well-drained, deep, nearly level to gently sloping soils on outwash terraces; friable, granular silt loam surface layer and firm, subangular blocky silty clay loam or friable gravelly clay loam subsoil; calcareous, stratified sand and gravel generally occur at depth of 60 inches, but depth ranges from 42 to 70 inches or more; slopes stable; water table seasonally deep.	0–10	Silt loam
OcB	Ockley silt loam, 2 to 6 percent slopes.		10–38	Silt loam to silty clay loam.
			38–60	Gravelly clay loam to gravelly silt loam.
			60–68	Stratified sand and gravel.
Pc	Pewamo silty clay loam.	Very poorly drained, deep, nearly level to depressional soil on uplands; friable, granular silty clay loam surface layer and firm, angular blocky to prismatic silty clay loam to silty clay subsoil; calcareous clay loam or silty clay loam till generally at depth of 48 inches, but depth ranges from 34 to 60 inches or more; ponding and flooding common; water table seasonally at or near the surface.	0–11	Silty clay loam
			11–48	Silty clay loam to silty clay.
			48–56	Clay loam or silty clay loam.
RdE2	Rodman soils, 12 to 50 percent slopes, eroded.	Well-drained, shallow, strongly sloping to extremely steep soils on outwash terraces; friable silt loam surface layer and shallow, friable gravelly clay loam subsoil; calcareous, stratified sand and gravel at depth of 10 inches; slopes stable; water table seasonally deep.	0–3	Silt loam
			3–10	Gravelly clay loam
			10–50	Stratified sand and gravel.
Ro	Ross loam.	Well-drained, deep soils on bottom lands; friable, granular silt loam or loam surface layer underlain by friable, very fine, subangular blocky silt loam or loam that, in turn, is underlain by friable, massive sandy clay loam to stratified loam, silt, and sand and gravel; periodic overflow during wet periods; water table seasonally at depth of about 3 feet or more.	0–23	Loam or silt loam
Rs	Ross silt loam.		23–38	Sandy clay loam
			38–42	Stratified silt, loam, sand, or gravel.

See footnotes at end of table.

Indiana, and their estimated properties—Continued

Classification—Continued		Percentage passing sieve—			Permeability	Available water capacity	Reaction	Frost potential	Shrink-swell potential
Unified	AASHO	No. 10	No. 40	No. 200					
					Inches per hour	*Inches per inch of soil*	*pH*		
ML or OL	A-4	100	90-100	80-90	0. 8-2. 5	0. 21	6. 1-6. 5	Moderate or high.	Low.
CL	A-6 or A-7	95-100	95-100	80-95	0. 2-0. 8	. 19	5. 1-6. 0	Moderate	Moderate.
ML or CL	A-4 or A-6	95-100	70-80	60-70	0. 2-0. 8	. 16	(1)	Moderate	Low or moderate.
ML or CL	A-4	100	90-100	75-95	0. 8-2. 5	. 21	6. 1-6. 5	High	Low.
CL or CH	A-7	100	90-100	75-85	0. 2-0. 8	. 19	5. 6-6. 0	High	Moderate or high.
CL	A-6	95-100	80-90	70-85	0. 2-0. 8	. 17	(1)	High	Moderate.
ML	A-4	100	95-100	85-95	0. 8-2. 5	. 21	5. 6-6. 5	Moderate or high.	Low.
ML or CL	A-4 or A-6	100	95-100	70-90	0. 2-2. 5	. 19	5. 1-6. 0	Moderate	Low or moderate.
SC or CL	A-4 or A-6	95-100	70-80	35-65	0. 2-2. 5	. 16	6. 1-6. 5	Moderate	Moderate.
SP-SM or SP.	A-1	65-75	25-35	0-10	10+	. 03	(1)	Low	Low.
CL or OH	A-7	95-100	95-100	80-100	0. 2-0. 8	. 21	6. 6-7. 3	Moderate	Moderate.
CL or CH	A-7	95-100	95-100	80-95	0. 05-0. 8	. 19	6. 6-7. 3	Moderate or high.	High.
CL	A-7	95-100	95-100	80-90	0. 2-0. 8	. 16	(1)	Moderate or high.	High.
ML	A-4	100	90-100	85-95	0. 8-2. 5	. 20	6. 6-7. 3	High	Low.
CL	A-6	95-100	80-90	60-70	0. 2-2. 5	. 16	6. 6-8. 4	Moderate	Moderate.
GP or SP-SM.	A-1	25-35	5-10	0-10	10+	. 03	(1)	Low	Low.
ML or OL	A-4	95-100	90-100	85-95	0. 8-2. 5	. 22	6. 6-7. 3	Moderate or high.	Low.
CL	A-6	95-100	70-80	50-60	0. 8-2. 5	. 19	7. 3-8. 4	Moderate	Low or moderate.
SM or ML	A-4	85-90	35-70	40-50	2. 5-5. 0	. 15	(1)	Moderate	Low.

TABLE 5.—*Brief description of soils of Madison County*

Map symbol	Soil	Description of soil and site	Depth from surface	Classification
				USDA texture
			Inches	
Sh	Shoals silt loam.	Somewhat poorly drained, deep, nearly level soil on bottom lands; friable, granular silt loam surface layer underlain by friable, granular to subangular blocky silt loam; neutral to calcareous strata of loam, sand, and gravel occur, especially in lower part of profile; periodic overflow during wet periods; water table seasonally at a depth of about 1 to 3 feet.	0–6 6–40	Silt loam Silt loam or silt loam and strata of sand and gravel.
Sl	Sleeth silt loam.	Somewhat poorly drained, deep, nearly level soil on outwash terraces; friable, granular silt loam surface layer and firm, subangular blocky silty clay loam subsoil; calcareous, stratified sand and gravel generally at depth of 48 inches, but depth ranges from 42 to 70 inches or more; slopes stable; water table seasonally at depth of about 1 to 3 feet.	0–16 16–48 48–60	Silt loam Silty clay loam or clay loam. Sand and gravel
Sm	Sleeth silt loam, loamy substratum.	Somewhat poorly drained, deep, nearly level soil on outwash terraces; friable, granular silt loam surface layer and firm, angular or subangular to massive silty clay loam or silt loam subsoil; calcareous silt and fine sand generally at depth of 44 inches, but depth ranges from 42 to 60 inches; slopes stable; water table seasonally at depth of 1 to 3 feet.	0–13 13–44 44–52	Silt loam Silty clay loam or silt loam. Stratified sand and silt.
So	Sloan silt loam.	Very poorly drained, deep, nearly level to depressional soil on bottom lands; friable, granular to subangular blocky silt loam surface layer underlain by friable, subangular blocky silty clay loam or silt loam; calcareous strata of loam, sand, and gravel occur, especially in lower part of profile; periodic overflow; water table seasonally at or near the surface.	0–17 17–47 47–52	Silt loam Silty clay loam Silt loam or loam
Wa	Wallkill complex.	Very poorly drained, deep, nearly level to depressional soil; friable, granular silt loam surface layer 10 to 40 inches thick underlain by organic material; depth to calcareous material ranges from 40 to 65 inches; periodic overflow and ponding; water table seasonally at or near the surface.	0–18 18–48	Silt loam Muck and peat
Wc	Washtenaw complex.	Very poorly drained, deep. nearly level to depressional soil; friable, granular silt loam surface layer 10 to 40 inches thick underlain by a buried soil that is dark-colored, firm, angular blocky silty clay loam or clay loam; depth to calcareous material is more than 42 inches; periodic overflow and ponding; water table seasonally at or near the surface.	0–19 19–31 31–68 68–72	Silt loam Silty clay loam or clay loam. Silty clay loam or clay loam. Silt, sand, gravel, or till.
Wd	Westland silty clay loam.	Very poorly drained, deep, nearly level to depressional soil on outwash terraces; friable, granular silty clay loam surface layer and firm, angular blocky silty clay loam subsoil; calcareous sand and gravel generally at depth of 49 inches, but depth ranges from 42 to 70 inches or more; ponding common; water table seasonally at or near the surface.	0–14 14–49 49–60	Silty clay loam Silty clay loam to sandy clay loam. Stratified sand and gravel.
Ws	Westland silty clay loam, moderately deep.	Very poorly drained, moderately deep, nearly level to depressional soil on outwash terraces; friable, granular to subangular blocky silty clay loam surface layer and firm, angular blocky clay loam subsoil; calcareous, stratified sand and gravel generally at depth of 31 inches, but depth ranges from 24 to 42 inches or more; ponding and flooding common; water table seasonally at or near the surface.	0–14 14–31 31–40	Silty clay loam Clay loam Sand and gravel

[1] Calcareous.
[2] The limestone underlying these soils commonly extends to depths of 50 to 60 feet.

Indiana, and their estimated properties—Continued

Classification—Continued		Percentage passing sieve—			Permeability	Available water capacity	Reaction	Frost potential	Shrink-swell potential
Unified	AASHO	No. 10	No. 40	No. 200					
					Inches per hour	*Inches per inch of soil*	*pH*		
ML or OL	A-4	100	90–100	85–95	0. 8–2. 5	0. 22	6. 6–8. 4	High	Low.
ML	A-4	100	95–100	75–95	0. 8–2. 5	. 22	6. 6–8. 4	High	Low.
ML	A-4	100	95–100	80–90	0. 8–2. 5	. 21	5. 6–6. 0	High	Low.
CL or CH	A-6 or A-7	95–100	85–95	75–85	0. 2–0. 8	. 18	5. 1–6. 0	Moderate or high.	High.
SP–SM or SM.	A-1	35–45	20–35	5–20	5. 0–10+	. 04	[1]	Low	Low.
ML	A-4	100	95–100	85–95	0. 8–2. 5	. 21	5. 6–6. 5	Moderate or high.	Low.
CL	A-6	95–100	90–100	80–95	0. 2–0. 8	. 19	5. 1–6. 0	Moderate	Moderate.
SM or ML	A-4	95–100	70–80	60–80	0. 8–5. 0	. 15	[1]	Moderate or high.	Low.
ML or CL	A-4 or A-6	100	90–100	80–95	0. 2–0. 8	. 22	6. 6–7. 8	Moderate or high.	Low or moderate.
CL	A-7	95–100	95–100	85–95	0. 2–0. 8	. 20	6. 6–7. 8	Moderate	Moderate.
ML or CL	A-4 or A-6	100	95–100	50–90	0. 2–2. 5	. 16	6. 6–8. 4	Moderate	Low or moderate.
MC or CL	A-4	100	95–100	70–90	0. 8–2. 5	. 21	6. 6–7. 3	Moderate	Low.
Pt					2. 5–5. 0	>. 25	6. 6–7. 3	Low	Low.
ML	A-4	100	95–100	85–95	0. 8–2. 5	. 22	6. 6–7. 3	Moderate or high.	Low.
CL	A-6	95–100	85–95	75–85	0. 2–0. 8	. 19	6. 6–7. 3	Moderate	Moderate or high.
CL	A-6	95–100	85–95	75–85	0. 05–0. 2	. 19	6. 6–7. 8	Moderate	Moderate.
CL	A-4	95–100	75–85	50–65	0. 8–2. 5	. 11	[1]	Moderate or high.	Low.
CL or OL	A-6	100	95–100	85–95	0. 2–0. 8	. 19	6. 1–7. 3	Moderate	Moderate.
CL	A-6	100	90–100	75–90	0. 2–0. 8	. 17	6. 6–7. 3	Moderate	Moderate.
SP or SP–SM	A-1	65–75	25–35	0–10	10+	. 03	[1]	Low	Low.
CL	A-7	95–100	95–100	85–95	0. 2–0. 8	. 20	6. 6–7. 3	Moderate	Moderate.
CL	A-6	95–100	90–100	65–75	0. 2–0. 8	. 18	6. 6–7. 3	Moderate	Moderate.
GP or SP–SM	A-1	25–35	5–10	0–10	10+	. 03	[1]	Low	Low.

TABLE 6.—*Interpretations of*

Soil series and map symbols	Suitability as source of—			Soil features affecting—		
	Topsoil	Sand and gravel	Road subgrade material	Highway location	Farm ponds: Reservoir areas	Farm ponds: Embankment
Blount (BoA, BoB2).	Fair or good	Unsuitable: no sand or gravel.	Subsoil: poor; high volume change; difficult to compact when wet. Substratum: fair to poor; moderate to high volume change; seasonally high water table.	High water table in spring; low permeability in subsoil and parent material.	Slow permeability in subsoil.	Slowly permeable material.
Brookston (Br, Bs)	Poor	Unsuitable: no sand or gravel.	Poor: normally not used for subgrade; road fill generally placed on top of these soils; plastic material.	High water table; periodic flooding.	Slow permeability in subsoil; parent material may have seams of sand and gravel mixed with loam till; location good for dugout ponds; depth of ponds depends on height of water table.	Slow permeability in subsoil; soil material generally not used because ponds are dug.
Camden (CaA, CaB2).	Good	Fair or poor: at least 3 feet of overburden on good strata of fine sand interbedded with silt and a lesser amount of gravel.	Fair in subsoil; good in substratum.	Cuts and fills needed in many places; fair to good bearing capacity; substratum has good stability.	Moderate permeability in subsoil; moderate to rapid permeability in underlying material.	Moderate permeability in subsoil; underlying material not suitable because of silt and sand.
Carlisle (Cm)	Good: peat at depth of 3 feet.	Unsuitable: at least 3½ feet of muck and peat need to be removed to determine if sand and gravel are present; dipper equipment necessary because water table is near the surface.	Unsuitable: muck and peat need to be removed before fill is used.	High water table; periodic flooding; muck and peat at depth of more than 42 inches.	Moderate permeability in muck and peat; location good for dugout ponds; depth of ponds depends on height of water table.	Organic material; generally not used because ponds are dug.
Celina (CnA, CnB2).	Good	Unsuitable: no sand or gravel.	Poor or fair in subsoil; fair in underlying material.	Cuts and fills needed in many places; unstable when wet; fair to poor bearing capacity; subject to frost heave.	Moderate permeability in subsoil; parent material may have thin seams of sand or porous material.	Moderate permeability in subsoil.
Clay pits (Cp)	Unsuitable: have been stripped of all topsoil.	Unsuitable: no sand or gravel.	Poor	Road fill needed to level pits.	Slow permeability and seepage in subsoil.	Slow permeability and seepage in subsoil.

engineering properties of soils

Soil features affecting—Continued				Soil limitations for—	
Agricultural drainage	Irrigation	Terraces and diversions	Grassed waterways	Disposal fields for septic tanks	Building sites
Slow permeability in subsoil; seasonally high water table; tile needed for subsurface drainage; lines should be 50 to 80 feet apart and at a depth of 36 to 42 inches; only random tile may be needed on upper slopes.	Shallow surface soil; erosion hazard; poorly drained subsoil; irrigation generally not suitable.	Soil properties favorable.	Soil properties favorable.	Severe: seasonally high water table; slow permeability in subsoil and underlying material.	Severe: seasonally high water table.
Slow permeability in subsoil; seasonally high water table and ponding; tile needed for subsurface drainage; lines should be 100 feet apart and at a depth of 36 to 42 inches and should be supplemented with surface drainage.	Adequate moisture supply; irrigation generally not needed.	Soil properties favorable; generally not needed because of topography; diversions may be used to divert excess water from higher soils.	Soil properties favorable.	Very severe: high water table; periodic flooding and ponding.	Severe: high water table; periodic flooding and ponding.
Moderate permeability; drainage not needed.	Moderate to high water-holding capacity; suitable for irrigation.	Soil properties favorable; generally not needed because of topography.	Soil properties favorable.	Slight: substratum of porous sand and gravel; hazard of contamination of ground water; moderate permeability.	Slight: medium shear strength and low compressibility; permeable; low shrink-swell potential.
High water table; flooding; poor outlets; open ditches needed; ditches should be 200 feet apart and at a depth of 3 feet, with side slopes of 1:1; use tile after initial subsidence; lines should be 80 to 100 feet apart and at a depth of 48 to 60 inches.	Controlled drainage needed with irrigation.	Not needed because of topography.	Soil properties favorable.	Very severe: high water table; periodic flooding and ponding; organic soil.	Severe: high water table; organic material.
Moderately permeable material; tile generally not needed.	Soil properties satisfactory; topography needs to be considered.	Soil properties favorable.	Soil properties favorable.	Moderate: moderately slow permeability.	Fair to good: fair to poor bearing capacity; moderate volume change; medium shear strength; subject to frost heave.
Drainage difficult because pits are lower than surrounding soils.	Poor farming soil; slow intake rate questionable.	Not needed	Not needed	Very severe because of their clay and position.	Not suitable: pits usually fill with water.

TABLE 6.—*Interpretations of engineering*

Soil series and map symbols	Suitability as source of—			Soil features affecting—		
	Topsoil	Sand and gravel	Road subgrade material	Highway location	Farm ponds	
					Reservoir areas	Embankment
Crosby (CrA, CrB2).	Fair	Unsuitable: no sand or gravel.	Poor or fair in subsoil; fair in underlying material.	Seasonally high water table.	Slow permeability in subsoil.	Slow permeability in subsoil.
Edwards (Ed)	Good	Unsuitable: muck and peat need to be removed before fill is used; underlain by marl.	Poor or unsuitable: road fill generally placed on top of this soil; underlain by marl.	High water table; unstable material; muck and peat.	Moderately permeable muck and peat; location good for dugout ponds; depth of ponds depends on height of water table.	Organic material generally not used because ponds are dug.
Eel (Es)	Good	Poor or unsuitable: location of sand and gravel spotty; deep overburden; dipper equipment necessary.	Fair: normally not used for subgrade; road fill is generally placed on top of this soil.	Flooding unless protected by levees.	Location good for dugout ponds; depth of ponds depends on height of water table.	Variable texture; generally not used because ponds are dug.
Fox fine sandy loam (FaA, FaB).	Fair	Good: at least 2 feet of overburden on good strata of fine to coarse sand and gravel interbedded with well-graded mixture of sand and gravel.	Good	At least 2 feet of overburden on good strata of fine to coarse sand and gravel; well drained; well suited.	Moderate permeability in subsoil; rapid permeability and seepage in underlying material.	Very permeable sandy or gravelly material.
Fox silt loam (FoA, FoB2, FoC2, FoD2).	Good	Good: at least 2½ feet of overburden on good strata of fine to coarse sand interbedded with well-graded mixture of sand and gravel.	Good	Well-drained soils; loose sand is easy to excavate but at times hinders hauling; well suited.	Moderate permeability in subsoil; rapid permeability and seepage in underlying material.	Very permeable sandy or gravelly material.
Fox, limestone substratum (FrA).	Good	Unsuitable: no sand or gravel.	Poor or fair in subsoil; limestone at depth of 18 to 42 inches.	Limestone bedrock at depth of 18 to 42 inches.	Moderate permeability in subsoil; limestone bedrock at depth of 18 to 42 inches or more.	Moderate permeability in subsoil; limestone at depth of 18 to 42 inches or more.

properties of soils—Continued

Soil features affecting—Continued				Soil limitations for—	
Agricultural drainage	Irrigation	Terraces and diversions	Grassed waterways	Disposal fields for septic tanks	Building sites
Seasonally high water table; poor drainage in subsoil; tile needed for subsoil drainage; lines should be 50 to 80 feet apart and at a depth of 36 to 42 inches; only random tile may be needed on upper slopes.	Somewhat poor drainage in subsoil; good drainage system needs to be installed and maintained.	Soil properties favorable.	Soil properties favorable.	Severe: seasonally high water table.	Severe: seasonally high water table.
High water table; flooding; use open ditches that are spaced 200 feet apart and at a depth of 3 feet and have 1:1 size slopes; control water table with low-cost dams; tile not recommended.	Controlled drainage needed if irrigated.	Not needed because of topography.	Soil properties favorable.	Very severe: high water table; periodic flooding; organic material over marl.	Very severe: high water table; ponding; organic material.
Poor drainage in subsoil; impounded floodwater; tile needed for subsurface drainage; lines should be spaced 50 to 80 feet apart and at a depth of 36 to 42 inches; to remove impounded water, tile lines should be supplemented with random tile or parallel, shallow surface drains.	Poor drainage; flooding; generally not suitable.	Soil properties favorable; generally not needed because of topography.	Soil properties favorable.	Severe: seasonally flooded; seasonally high water table.	Severe: seasonally flooded.
Moderately to rapidly permeable soil material; drainage not needed.	Medium to low water-holding capacity; rapid intake rate; frequent applications of water needed.	Soil properties favorable; generally not needed because of topography.	Soil properties favorable.	No restrictions other than possible pollution of water supply by effluent; suitable.	None: Subsoil fair to good; below 3 feet very good; well drained; gravel and sand substratum.
Moderately to rapidly permeable soil material; drainage not needed.	Medium to low water-holding capacity; rapid intake rate; frequent applications of water needed; not suitable on steeper slopes.	Subsoil favorable; gravel and sand at depth of less than 42 inches.	Soil properties favorable on lower slopes; low water-holding capacity on steeper slopes.	Slight but tile should be placed on the contour on the steeper slopes.	None: subsoil fair to good; below 3 feet very good; well drained; gravel and sand substratum.
Moderately permeable soil material; limestone at depth of 18 to 42 inches; drainage not needed.	Moderate water-holding capacity; tends to be droughty because of limestone at depth of 18 to 42 inches or more.	Soil properties favorable, but limestone may prevent terracing.	Soil properties favorable; limestone at depth of 18 to 42 inches.	Severe: limestone bedrock at depth of 18 to 42 inches.	Generally moderate but slight on limestone bedrock.

TABLE 6.—*Interpretations of engineering*

Soil series and map symbols	Suitability as source of— Topsoil	Suitability as source of— Sand and gravel	Suitability as source of— Road subgrade material	Soil features affecting— Highway location	Soil features affecting— Farm ponds: Reservoir areas	Soil features affecting— Farm ponds: Embankment
Fox, till substratum (FsA, FsB, FsB2, FsC, FsC2, FxB3).	Good to poor	Poor or unsuitable: may have thin deposits of unassorted sandy and gravelly material above the till.	Fair to good	Cuts and fills needed in many places; fair to poor bearing capacity; subject to frost heave.	Moderate to rapid permeability; seepage rate depends on thickness of layer of sand and gravel, if present.	Moderate permeability in subsoil; rapid permeability in layer of sand and gravel.
Fox soils (FtC3)	Unsuitable	Good: 2 feet or less of overburden on good strata of fine to coarse sand interbedded with well-graded mixture of sand and gravel.	Good	Good drainage; loose sand and gravel easy to excavate but sometimes hinders hauling.	Moderate permeability in subsoil; rapid permeability and seepage in underlying material.	Very permeable sandy or gravelly soil material.
Genesee (Gn)	Good	Poor to unsuitable: location of sand and gravel spotty; deep overburden; dipper equipment necessary.	Fair: normally not used for subgrade; road fill generally placed on top of this soil.	Flooding unless protected by levees.	Location satisfactory for dugout ponds.	Variable texture.
Gravel pits (Gr)	Good in upper layers of undisturbed soil.	Good	Good in high, dry pits; unsuitable in low, wet pits.	Road fill needed to level pits.	Rapid permeability; features depend on location; location of low, wet gravel pits good.	Variable texture; too much coarse material.
Hennepin (HeF2)	Poor to unsuitable.	Poor or unsuitable: location of sand and gravel spotty.	Poor in subsoil; fair in underlying material.	Soil material favorable; topography is a problem.	Moderate permeability; if pockets of sand and gravel occur, seepage may be rapid.	Moderately permeable material.
Homer (Hm)	Poor to fair	Good: at least 2 feet of overburden on good strata of fine to coarse sand and gravel interbedded with well-graded mixture of sand and gravel; dipper equipment necessary because of water table.	Fair	Slow permeability in subsoil; high water table in spring.	Slow permeability in subsoil; seepage rapid through sand and gravel; location good for dugout ponds.	Slow permeability in subsoil, but if subsoil and underlying material are mixed, coarser sand and gravel may increase permeability.
Homer, limestone substratum (Hn)	Fair	Unsuitable: no sand or gravel.	Poor or fair in subsoil; substratum is limestone bedrock at depth of 18 to 42 inches.	Seasonally high water table; features of subsoil fair or poor; substratum is limestone bedrock at depth of 18 to 42 inches.	Slow permeability in subsoil; limestone bedrock at depth of 18 to 42 inches.	Slow permeability in subsoil; limestone bedrock at depth of 18 to 42 inches.

properties of soils—Continued

Soil features affecting—Continued				Soil limitations for—	
Agricultural drainage	Irrigation	Terraces and diversions	Grassed waterways	Disposal fields for septic tanks	Building sites
Moderately permeable soil material; drainage not needed.	Moderate water-holding capacity; application of water depends on thickness of layer of sand and gravel; not suitable on steeper slopes and in severely eroded areas.	Soil properties favorable.	Soil properties favorable; vegetation may be difficult to establish.	Moderate: substratum moderately slow in permeability.	Slight: banks need to be stabilized in sloping areas; measures to control erosion necessary.
Moderately to rapidly permeable soil material; drainage not needed.	Low water-holding capacity; rapid intake rate; not suitable.	Gravel and sand at shallow depth; generally not suitable because of topography.	Gravel and sand at shallow depth; somewhat droughty.	Slight but tile should be placed on the contour on the steeper slopes.	Slight.
Moderately permeable soil material; drainage generally not needed.	Soil material satisfactory; subject to occasional overflow that may be a hazard.	Soil properties favorable; not needed because of topography.	Soil material favorable; subject to flooding.	Severe: seasonally flooded; seasonally high water table.	Severe: seasonally flooded.
Does not apply	Does not apply	Does not apply	Does not apply	Very severe: pits are usually deep and contain water.	Very severe: pits are usually deep and contain water.
Drainage not needed because of topography.	Steep slopes	Steep slopes	Steep slopes; soil properties fair.	Slight but tile should be placed on the contour.	Slight: steep slopes; banks may need to be stabilized.
Slow permeability in subsoil; seasonally high or perched water table; tile, with special filters, needed for subsurface drainage; lines should be 100 to 150 feet apart and at a depth of 36 to 48 inches and should be supplemented with surface drainage.	Slow permeability in subsoil; good drainage system should be installed and maintained.	Soil properties favorable; generally not needed because of topography.	Soil properties favorable.	Severe: seasonally high water table.	Severe: seasonally high water table.
Slow permeability in subsoil; seasonally high water table; shallow surface drains needed; subsurface drainage not suitable because of shallow depth to rock.	Slow permeability in subsoil; depth to limestone is 18 to 42 inches; tends to be droughty.	Subsoil properties favorable; limestone at depth of 18 to 42 inches.	Soil properties favorable if limestone is not too near the surface.	Severe: seasonally high water table; limestone bedrock.	Moderate: high water table; fair bearing capacity; moderate volume change; medium shear strength.

TABLE 6.—*Interpretations of engineering*

Soil series and map symbols	Suitability as source of— Topsoil	Sand and gravel	Road subgrade material	Soil features affecting— Highway location	Farm ponds: Reservoir areas	Farm ponds: Embankment
Kokomo (Kc)	Good	Unsuitable: no sand or gravel.	Poor: normally not used for subgrade; road fill generally placed on top of the soil; plastic material.	High water table; periodic flooding.	Very slow permeability in subsoil; thin seams of sand and gravel mixed with loam till may be in parent material; good location for dugout ponds.	Very slow permeability in subsoil.
Kokomo, gravelly substratum (Kg, Kt).	Poor	Good: at least 3½ feet of overburden on good strata of fine to coarse sand interbedded with well-graded mixture of sand and gravel; dipper equipment necessary because water table is near the surface.	Poor: normally not used for subgrade; road fill generally placed on top of these soils; plastic material.	High water table; periodic flooding; mucky phase may have as much as 12 inches of muck.	Slow permeability in subsoil; sand and gravel at depth of 42 to 70 inches or more; location good for dugout ponds; depth of ponds depends on height of water table.	Slow permeability in subsoil; soil material generally not used because ponds are dug.
Kokomo, stratified substratum (Km, Ks).	Fair or good	Poor or unsuitable: at least 3 feet of overburden on silt, sand, and a small amount of gravel and clay material; dipper equipment necessary because water table is near the surface.	Poor: normally not used for subgrade; road fill is generally placed on top of these soils.	High water table; periodic flooding or ponding; mucky phase may have as much as 12 inches of muck.	Slow to very slow permeability in subsoil; underlying material is mixed sand, silt, and a small amount of gravel and clay; location good for dugout ponds; depth of ponds depends on height of water table.	Slow to very slow permeability in subsoil; soil material generally not used because ponds are dug.
Linwood (Lm)	Good	Poor or unsuitable: silty and clayey material; at least 2 to 3 feet of muck or peat need to be removed to determine if sand and gravel are present; dipper equipment necessary because water table is near the surface.	Poor or unsuitable: muck and peat need to be removed before fill is used.	High water table; periodic flooding; muck and peat at depth of 12 to 42 inches.	Moderately permeable muck and peat; location good for dugout ponds.	Organic material generally not used because ponds are dug.
Made land (Ma)	Unsuitable	Unsuitable	Unsuitable	Variable soil material and fill.	Generally mixed soil material of unknown quality for ponds.	Generally mixed soil material of unknown quality.

properties of soils—Continued

Soil features affecting—Continued				Soil limitations for—	
Agricultural drainage	Irrigation	Terraces and diversions	Grassed waterways	Disposal fields for septic tanks	Building sites
Very slow permeability in subsoil; seasonally high water table and ponding; tile needed for subsurface drainage; lines should be placed 65 to 100 feet apart and at a depth of 36 to 42 inches and should be supplemented with surface drainage.	Adequate moisture supply; irrigation generally not needed.	Soil properties favorable; generally not needed; practices may be needed to remove excess water from higher soils.	Soil properties favorable.	Very severe: seasonally high water table; periodic flooding and ponding.	Very severe: seasonally high water table; periodic flooding and ponding.
Slow permeability in subsoil; seasonally high water table; tile needed for subsurface drainage; lines should be spaced 65 to 100 feet apart and at a depth of 36 to 42 inches and should be supplemented with surface drainage; if tile is placed deeper than 4 feet, sand and gravel may be a hazard.	Adequate moisture supply; irrigation generally not needed.	Soil properties favorable; generally not needed because of topography; practices may be needed to remove excess water from higher soils.	Soil properties favorable.	Very severe: high water table; periodic flooding and ponding.	Very severe: high water table; periodic flooding and ponding.
Slow permeability; seasonally high water table; ponding; tile needed for subsurface drainage; lines should be placed 65 to 100 feet apart and at a depth of 36 to 42 inches and should be supplemented with surface drainage.	Adequate moisture supply; irrigation generally not needed.	Soil material favorable; generally not needed because of topography; practices may be needed to remove excess water from higher soils.	Soil material favorable.	Very severe: high water table; periodic flooding.	Very severe: high water table; periodic flooding and ponding.
High water table; flooding; poor outlets; tile needed for subsurface drainage; lines should be spaced 65 to 100 feet apart and at a depth of 36 to 48 inches and should be supplemented with open ditches.	Controlled drainage needed if irrigated.	Not needed because of topography.	Soil properties favorable.	Very severe: high water table; periodic flooding and ponding.	Very severe: organic material; high water table and ponding.
Field investigation needed to determine type of fill and lower soil.	Generally not suitable.	Field investigation to determine if needed.	Field investigation to determine if needed.	Field investigation needed to determine type of fill and lower soil material.	Field investigation needed to determine type of fill and lower soil material.

TABLE 6.—*Interpretations of engineering*

Soil series and map symbols	Suitability as source of—			Soil features affecting—		
	Topsoil	Sand and gravel	Road subgrade material	Highway location	Farm ponds: Reservoir areas	Farm ponds: Embankment
Mahalasville (Mh, Ml).	Good	Poor or unsuitable: at least 3 feet of overburden on silt, sand, and a small amount of gravel and clay material; dipper equipment necessary because water table is near the surface.	Poor: normally not used for subgrade; road fill generally placed on top of these soils.	High water table; periodic flooding or ponding.	Slow permeability in subsoil; underlying material is mixed sand, silt, and a small amount of gravel and clay; location good for dugout ponds.	Slow permeability in subsoil.
Mahalasville, limestone substratum (Mm).	Poor	Unsuitable: underlain by limestone at depth of 18 to 42 inches.	Poor: normally not used for subgrade; fill generally placed on top of this soil.	High water table; periodic flooding and ponding; limestone bedrock at depth of 18 to 42 inches.	Slow to very slow permeability in subsoil; limestone bedrock at depth of 18 to 42 inches.	Slow to very slow permeability in subsoil; limestone bedrock at depth of 18 to 42 inches.
Miami (MnA, MnB2, MnC2, MnD2, MnE2).	Good	Poor or unsuitable: in some areas there are pockets of unassorted sand and gravel and good strata of fine to coarse sand interbedded with well-graded mixture of sand and gravel; overburden at least 8 to 10 feet thick.	Poor or fair in subsoil; fair in underlying material.	Cuts and fills needed in many places; fair to poor bearing capacity; subject to frost heave.	Moderate to moderately slow permeability in subsoil.	Moderate to moderately slow permeability in subsoil; moderate permeability in substratum.
Miami soils (MpB3, MpC3, MpD3, MpE3).	Unsuitable	Poor or unsuitable	Poor or fair in subsoil; fair in underlying material.	Cuts and fills needed in many places; fair to poor bearing capacity; subject to frost heave.	Moderate to moderately slow permeability in subsoil.	Moderate to moderately slow permeability in subsoil; moderate permeability in substratum.
Morley (MrB2, MrC2, MrD).	Fair	Unsuitable: no sand or gravel.	Poor: plastic material.	Cuts and fills needed in many places; fair to poor bearing capacity; subject to frost heave.	Moderate to slow permeability in subsoil; satisfactory for ponds.	Moderately to slowly permeable soil material.
Morley soils (MsB3, MsC3, MsD3).	Poor	Unsuitable	Poor: plastic material.	Cuts and fills needed in many places; fair to poor bearing capacity; subject to frost heave.	Moderate to slow permeability in subsoil; satisfactory for ponds.	Moderately to slowly permeable soil material.

properties of soils—Continued

Soil features affecting—Continued				Soil limitations for—	
Agricultural drainage	Irrigation	Terraces and diversions	Grassed waterways	Disposal fields for septic tanks	Building sites
Slow permeability; seasonally high water table; ponding; tile needed for subsurface drainage; lines should be spaced 65 to 100 feet apart and at a depth of 36 to 42 inches and should be supplemented with surface drainage.	Adequate moisture supply; irrigation generally not needed.	Soil properties favorable; generally not needed because of topography; practices may be needed to remove excess water from higher soils.	Soil properties favorable.	Very severe: high water table; periodic flooding and ponding.	Very severe: high water table; periodic flooding and ponding.
Slowly to very slowly permeable soil material; high water table; impounded surface water; subsurface drainage generally not needed because of shallow depth to rock; surface drainage needed in some areas.	Adequate moisture supply; irrigation generally not needed.	Soil properties favorable; limestone at depth of 18 to 42 inches; generally not needed because of topography; practices may be needed to remove excess water from higher soils.	Soil properties favorable; limestone at depth of 18 to 42 inches.	Severe: limestone at depth of 18 to 42 inches.	Severe: poor drainage.
Moderately permeable soil material; drainage not needed.	Moderate to high water-holding capacity on nearly level and gently sloping areas, but moderate to low on steeper slopes or in severely eroded areas; hazard of erosion on steeper slopes makes irrigation impractical.	Soil properties favorable.	Soil properties favorable.	Moderate but tile should be placed on the contour on steeper slopes.	Slight but practices to control erosion needed on steeper slopes.
Moderately permeable soil material; drainage not needed.	Moderate to low water-holding capacity; not suitable because of slope and hazard of erosion.	Soil properties favorable.	Soil properties favorable.	Slight but tile should be placed on the contour on steeper slopes.	Slight but practices to control erosion needed.
Moderately permeable soil material; subsurface drainage necessary in some areas because of seepage.	Moderate to high water-holding capacity; poor soil for irrigation.	Soil material favorable.	Soil material favorable.	Severe: heavy subsoil and underlying material; tile should be placed on the contour on steeper slopes.	Moderate but practices to control erosion needed on steeper slopes.
Moderately to slowly permeable soil material; subsurface drainage necessary in some areas because of seepage.	High water-holding capacity; poor soil for irrigation; slope and erosion are factors against irrigation.	Soil material favorable.	Soil material favorable.	Severe: heavy subsoil and underlying material; tile should be placed on the contour on steeper slopes.	Moderate but practices to control erosion needed on steeper slopes.

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TABLE 6.—*Interpretations of engineering*

Soil series and map symbols	Suitability as source of—			Soil features affecting—		
	Topsoil	Sand and gravel	Road subgrade material	Highway location	Farm ponds: Reservoir areas	Farm ponds: Embankment
Ockley (OcA, OcB).	Good	Good: at least 3 feet of overburden on good strata of fine to coarse sand interbedded with well-graded mixture of sand and gravel.	Fair in subsoil; good in substratum.	Good drainage; underlying gravel and sand easy to excavate but sometimes hinders hauling; good bearing strength.	Moderate permeability in subsoil; rapid permeability and seepage in substratum.	Moderate permeability in subsoil; underlying material is not suitable.
Pewamo (Pc)	Good to poor	Unsuitable: no sand or gravel.	Poor: normally not used for subgrade; road fill generally placed on top of this soil; plastic material.	High water table; periodic flooding and ponding.	Slow permeability in subsoil; location good for dugout ponds; depth of ponds depends on height of water table.	Slow permeability in subsoil; material generally not used because ponds are dug.
Rodman (RdE2)	Poor	Good: good strata of fine to coarse sand interbedded with well-graded mixture of sand and gravel.	Good	Good: mostly gravel and sand.	Cuts and fills needed; steep topography; material good; erodible on slopes.	Moderate to rapid permeability in subsoil; very permeable sand and gravel.
Ross (Ro, Rs)	Good	Poor or unsuitable: location of sand and gravel spotty; deep overburden; dipper equipment necessary.	Poor: normally not used for subgrade; fill generally placed on top of these soils.	Periodic flooding; poor to unsuitable.	Location satisfactory for dugout ponds.	Variable texture; generally not used because ponds are dug.
Shoals (Sh)	Good	Poor to unsuitable: location of sand and gravel spotty; deep overburden; dipper equipment necessary.	Poor: normally not used for subgrade; fill generally placed on top of this soil.	Seasonally high water table; flooding unless protected by levees.	Location good for dugout ponds; depth of ponds depends on height of water table.	Variable texture; generally not used because ponds are dug.
Sleeth (Sl)	Fair to poor	Good: at least 3 feet of overburden on good strata of fine to coarse sand interbedded with well-graded mixture of sand and gravel; dipper equipment necessary.	Fair in subsoil; good in underlying material.	Seasonally high water table.	Slow permeability in subsoil; sand and gravel at depth of 42 to 70 inches or more.	Slow permeability in subsoil; sand and gravel at depth of 42 to 70 inches or more.

properties of soils—Continued

Soil features affecting—Continued				Soil limitations for—	
Agricultural drainage	Irrigation	Terraces and diversions	Grassed waterways	Disposal fields for septic tanks	Building sites
Moderately permeable soil material; drainage not needed.	Moderate to high water-holding capacity; suitable for irrigation.	Soil properties favorable.	Soil properties favorable.	No restrictions other than possible pollution of water supply by effluent; suitable.	Subsoil fair to good; substratum very good; good bearing capacity.
Slow permeability in subsoil; seasonally high water table; ponding; tile needed for subsurface drainage; lines should be 65 to 100 feet apart and at a depth of 36 to 42 inches and should be supplemented with surface drainage.	Adequate moisture supply; irrigation generally not needed.	Soil properties favorable; generally not needed because of topography; practices may be needed to remove excess water from higher soils.	Soil properties favorable.	Very severe: high water table; periodic flooding and ponding; heavy underlying material.	Severe; high water table; periodic flooding and ponding.
Rapidly permeable soil material; drainage not needed.	Low water-holding capacity; rapid intake; frequent applications of water needed; generally not suitable because of slope and hazard of erosion.	Steep slopes; sand and gravel material.	Steep slopes; erosion hazard; vegetation difficult to establish; low water-holding capacity.	Slight but tile should be placed on the contour; steep topography makes installation of filter fields difficult; possible pollution of water supply by effluent.	Slight but practices to control erosion needed; good to fair bearing capacity; low volume change; very low compressibility.
Moderately permeable soil material; drainage not needed.	Soil material satisfactory; subject to occasional overflow.	Soil properties favorable; not needed because of topography.	Soil properties favorable; subject to flooding.	Very severe: occasional overflow and flooding; seasonally high water table.	Severe: occasional flooding.
Poor drainage in subsoil; impounded floodwater; tile needed for subsurface drainage; lines should be 50 to 80 feet apart and at a depth of 36 to 42 inches and should be supplemented with shallow surface drainage.	Poor drainage and flooding; generally not recommended.	Soil properties favorable; not needed because of topography.	Soil material favorable.	Very severe: flooding and ponding; seasonally high water table.	Very severe: flooding and ponding.
Seasonally high water table; tile needed for subsurface drainage; lines should be 50 to 80 feet apart and at a depth of 36 to 42 inches; if tile is laid deeper than 42 inches, sand and gravel may be a hazard.	Somewhat poorly drained subsoil; a good drainage system should be installed and maintained.	Soil material favorable but generally not needed because of topography.	Soil material favorable.	Moderate to severe: high water table; moderate to slow permeability.	Moderate: subsoil has medium shear strength and compressibility and moderate to low shrink-swell potential; substratum material is favorable but water table is high.

TABLE 6.—*Interpretations of engineering*

Soil series and map symbols	Suitability as source of—			Soil features affecting—		
	Topsoil	Sand and gravel	Road subgrade material	Highway location	Farm ponds	
					Reservoir areas	Embankment
Sleeth, loamy substratum (Sm).	Fair	Poor or unsuitable: at least 3 feet of overburden on silt, fine sand, and a minor amount of gravel and clayey material; dipper equipment necessary.	Fair in subsoil; fair to good in underlying material.	Seasonally high water table.	Moderate to slow permeability in subsoil; silt and sand at depth of 42 to 60 inches.	Moderate to slow permeability in subsoil; silt and sand at depth of 42 to 60 inches.
Sloan (So)	Good	Poor or unsuitable: location of sand and gravel spotty; deep overburden; dipper equipment necessary.	Poor: normally not used for subgrade; fill generally placed on top of this soil.	Flooding unless protected by levees.	Location good for dugout ponds; depth of ponds depends on height of water table.	Variable texture; generally not used because ponds are dug.
Wallkill (Wa)	Good	Poor or unsuitable: location of sand and gravel spotty; deep overburden; dipper equipment necessary.	Poor: normally not used for subgrade; muck and peat need to be removed before fill is placed on this soil.	High water table; periodic flooding and ponding; muck and peat at depth of 10 to 40 inches or more.	Location good for dugout ponds; depth of ponds depends on height of water table.	Variable texture; generally not used because ponds are dug.
Washtenaw (Wc)	Good	Poor to unsuitable: at least 3 to 4 feet of overburden; location of sand and gravel spotty; dipper equipment necessary.	Poor: normally not used for subgrade; road fill generally placed on top of this soil.	High water table; periodic flooding or ponding.	Slow permeability in subsoil; parent material may be sand, gravel, silt, or till; location good for dugout ponds; depth of ponds depends on height of water table.	Slow permeability in subsoil; generally not used because ponds are dug.
Westland (Wd)	Good	Good: at least 3½ feet of overburden on good strata of fine to coarse sand interbedded with well-graded mixture of sand and gravel; dipper equipment necessary because water table is near the surface.	Poor: normally not used for subgrade; road fill generally placed on top of this soil.	High water table; periodic flooding.	Slow permeability in subsoil; sand and gravel at depth of 42 to 70 inches or more; location good for dugout ponds; depth of ponds depends on height of water table.	Slow permeability in subsoil; generally not used because ponds are dug.

properties of soils—Continued

Soil features affecting—Continued				Soil limitations for	
Agricultural drainage	Irrigation	Terraces and diversions	Grassed waterways	Disposal fields for septic tanks	Building sites
Seasonally high water table; tile needed for subsurface drainage; lines should be 50 to 80 feet apart and at a depth of 36 to 42 inches; if tile is placed deeper than 42 inches, sand and silt may be a hazard.	Somewhat poor drainage; a good drainage system should be installed and maintained.	Soil material favorable; generally not needed because of topography; practices may be needed to remove excess water from higher soils.	Soil material favorable.	Severe: seasonally high water table.	Severe: poor drainage.
Poor drainage in subsoil; impounded floodwater; tile needed for subsurface drainage; lines should be 50 to 80 feet apart and at a depth of 36 to 42 inches and should be supplemented with shallow surface drainage.	Poor drainage; flooding; generally not suitable.	Soil material favorable; not needed because of topography.	Soil material favorable.	Very severe: seasonally high water table and flooded.	Very severe: seasonally flooded; poor drainage.
Seasonally high water table; ponding; tile needed for subsurface drainage; lines should be 80 to 200 feet apart and at a depth of 48 to 60 inches and should be supplemented with open ditches.	Poor drainage; flooding; generally not suitable.	Soil material favorable; not needed because of topography.	Soil material favorable.	Very severe: flooding or ponding; underlying material is muck or peat.	Very severe: flooding or ponding; underlying material is muck or peat.
Slow permeability in subsoil; seasonally high water table and ponding; recent alluvium; tile needed for subsurface drainage; lines should be 65 to 100 feet apart and at a depth of 36 to 42 inches and should be supplemented with surface drainage.	Adequate moisture supply; irrigation generally not needed.	Soil properties favorable; not needed because of topography.	Soil properties favorable.	Very severe: flooding and ponding; high water table.	Very severe: flooding and ponding; high water table.
Slow permeability in subsoil; seasonally high water table; ponding; tile needed for subsurface drainage; lines should be 65 to 100 feet apart and at a depth of 36 to 42 inches and should be supplemented by surface drainage; if tile is placed deeper than 4 feet, sand and gravel may be a hazard.	Adequate moisture supply; irrigation generally not needed.	Soil properties favorable; generally not needed because of topography; practices may be needed to remove excess water from higher soils.	Soil properties favorable.	Severe: flooding; poor drainage.	Severe: ponding and poor drainage.

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TABLE 6.—*Interpretations of engineering*

Soil series and map symbols	Suitability as source of—			Soil features affecting—		
	Topsoil	Sand and gravel	Road subgrade material	Highway location	Farm ponds	
					Reservoir areas	Embankment
Westland, moderately deep (Ws).	Good	Good: at least 2 feet of overburden on good strata of fine to coarse sand interbedded with well-graded mixture of sand and gravel; dipper equipment necessary because water table is near the surface.	Poor: generally not used for subgrade; road fill generally placed on top of this soil.	High water table; periodic flooding or ponding.	Location satisfactory for dugout ponds; depth of ponds depends on height of water table.	Slow permeability in subsoil; underlying material is sand and gravel; generally not used because ponds are dug.

Engineering classification systems

Two systems for classifying soils are in general use among engineers. They are the system approved by the American Association of State Highway Officials (AASHO) (*1*)[5] and the Unified system adopted by the Corps of Engineers, U.S. Army (*18*).

AASHO Classification.—The American Association of State Highway Officials has developed a classification based on the field performance of soil materials. In this system soils are classified in seven principal groups. The groups range from A–1, consisting of gravelly soils of high bearing capacity, to A–7, consisting of clay soils of low strength when wet. Peat, muck, or other highly organic soils are not included in this classification, because their use as a construction material or foundation material should be avoided.

Within each of the principal groups, the relative engineering value of the soil material is indicated by a group index number. Group indexes range from 0 for the best materials to 20 for the poorest. The group index for the horizons of the soils tested is shown in parentheses after the soil group symbol in the next to last column in table 4.

Unified Classification.—This classification is based on the identification of soils according to their texture, plasticity, and liquid limit. In the Unified system the three major groupings are coarse-textured soils (eight classes), fine-textured soils (six classes), and organic soils. The soils are in 15 classes: eight classes for coarse-grained material (GW, GP, GM, GC, SW, SP, SM, SC) six, for fine-grained material (ML, CL, OL, MH, CH, OH), and one for highly organic material (Pt).

Soil test data

Test data for the soils in Madison County are given in table 4. Samples from three soil series, which were selected by soil scientists, were taken from nine locations in the county. Only selected layers of each soil were sampled. These samples were tested according to standard procedures in the laboratories of the Joint Highway Research Project, Purdue University, under the sponsorship of the Bureau of Public Roads. The tests were made so that information could be obtained that would assist in the evaluation of the soils for engineering uses. The samples do not represent the entire range of soil properties in Madison County, or even within the three soil series sampled, but the results from the tests have been used as a guide in estimating the engineering properties of the soils in the county.

Both the AASHO and Unified classifications are listed in table 4. They are based on data obtained by mechanical analysis and from tests to determine the liquid and plastic limits. The mechanical analyses were made by combined sieve and hydrometer methods. The grain size of sand, silt, and clay used by engineers is not equivalent to grain size used by soil scientists. For example, clay, to soil scientists, refers to mineral grains less than 0.002 millimeter in diameter, but engineers frequently define the size of clay as less than 0.005 millimeter in diameter.

The liquid limit and plastic limit tests on the soil samples measure the effect of water on the consistency of soil material. As the moisture content of a clayey soil increases from a very dry state, the material changes from a semisolid to a plastic state. As the moisture content is further increased, the material changes from the plastic state to a liquid state. The plastic limit is the moisture content at which the soil material passes from a semisolid to a plastic state. The liquid limit is the moisture content at which the material passes from a plastic to a liquid state. The plasticity index is the numerical difference between the liquid limit and the plastic limit. It indicates the range of moisture content within which a soil material is in a plastic condition.

Table 4, under "Moisture-density," gives data on the relationship between the moisture content and the compacted density of the soil as determined by the standard methods described in AASHO Designation: T 99–57 (*1*). Also given are moisture relations obtained in the test for determining the California bearing ratio (CBR). If soil material is compacted at successively higher moisture content, assuming that the same amount of force is used

[5] Italic numbers in parentheses refer to Literature Cited, p. 89.

properties of soils—Continued

Soil features affecting—Continued				Soil limitations for—	
Agricultural drainage	Irrigation	Terraces and diversions	Grassed waterways	Disposal fields for septic tanks	Building sites
Slow permeability in subsoil; seasonally high water table; ponding; tile, with special filters, needed for subsurface drainage; lines should be 100 to 150 feet apart and at a depth of 36 to 48 inches and should be supplemented with open ditches; sand and gravel is the hazard for tile; controlled drainage is necessary.	Adequate moisture supply; irrigation generally not needed.	Soil properties favorable; generally not needed because of topography.	Soil properties favorable.	Very severe: high water table; periodic flooding.	Very severe: high water table and periodic flooding.

in compacting the soil, the density of the compacted material will increase until the "Optimum moisture" content is reached. After that, the density decreases with increase in moisture content. The oven-dry weight, in pounds per cubic foot of the soil at optimum moisture content, is the "Maximum dry density." Data on the relationship of moisture to density are important in planning earthwork because generally the soil is most stable if it is compacted to its maximum dry density when it is approximately at the optimum moisture content.

Engineering descriptions of soils

Table 5 gives an engineering description of the soils in Madison County and an estimate of their physical properties important in engineering. The soils and their sites are described from an engineering standpoint. Since actual tests were made on only those soils that were tested and are listed in table 4, it was necessary to estimate the engineering properties for the rest of the soils. In making these estimates, the soil scientists compared the untested soils with the tested soils and used the knowledge gained from working with similar soils in other areas. Without these estimates an engineer would have to provide for them himself.

Normally, in table 5, only the depth for the major horizons are listed, but other horizons are listed if they differ significantly from the major horizons.

Permeability refers to the movement of water downward through undisturbed soil material. It was estimated largely on the basis of texture, structure, and consistence.

Available water capacity refers to the amount of capillary water in the soils when it is wet to field capacity. This amount of water will wet a soil at wilting point to a depth of 1 inch, and the water will not penetrate deeper. The capacity of a particular horizon to deliver water to plant roots depends on whether the roots can reach the horizon.

Frost potential rates the degree that frost action affects the soil. Frost action is a major consideration if (1) water is present in the soil; (2) a low temperature exists long enough to permeate the soil; and (3) ice lenses are likely to form and cause the soil to lose strength when the lenses thaw after freezing.

Shrink-swell potential is the property that determines how much a soil changes in volume when its content of moisture changes. It is estimated mainly on the basis of the amount and kind of clay in the soil.

Engineering interpretations of soils

Table 6 rates the suitability of the soils as a source of topsoil, of sand and gravel, and of road subgrade material. It also names soil properties that affect the uses of the soils as highway locations, for constructing farm ponds, for agricultural drainage, for irrigation, for terraces and diversions, and grassed waterways. Also rated are limitations to the use of soils as disposal fields for septic tanks and as building sites.

Topsoil refers to soil material that is used on backslopes, embankments, lawns, and gardens for growing plants. The suitability rating is based primarily on texture and the content of organic matter. Sand and gravel are rated only for the material between the surface and a depth of 5 to 7 feet. Test pits are needed to determine the extent and quality of the sand and gravel. The suitability as source of road subgrade material was rated on the basis of the performance of the soil as subgrade. Both the subsoil and the substratum are rated when they differ. In rating highway location, soil features were considered that affect the overall performance of the soil; and the entire profile of an undisturbed soil, without artificial drainage, was evaluated.

Those features of an undisturbed soil that affect the seepage rate (permeability) were the primary concern when reservoir areas were considered. For embankments, features were considered that affect the use of undisturbed material in constructing embankments to impound surface water. For terraces and diversions, features that affect layout and construction were considered. Among these features are texture, permeability, and depth of the soil. Features that affect agricultural drainage are texture, permeability, topography, seasonal water table, and restricting layers. For irrigation, the properties evaluated

were soil depth, available moisture capacity, permeability, topography, seasonal variations in the water table, and restricting layers. For grassed waterways, features were considered that affect the establishment and growth of plants and the layout and construction of the waterway.

Properties that affect the construction and use of disposal systems for septic tanks are permeability, seasonal variations in the water table, susceptibility to flooding, and topography. Considered in determining limitations to use as building sites were those features limiting use as foundations for buildings of three stories or less. Generally, the substratum of a soil provides the base for foundations.

Use of soils as disposal fields for septic tanks and as building sites

Table 6 rates the soils in the county as disposal fields for septic tanks and as building sites. It also names the main limitations. In this subsection additional information on use of soils for these purposes is given.

DISPOSAL FIELDS FOR SEPTIC TANKS

Because many new homes in rural areas are far from existing sewage lines, septic tanks and a system for disposing of effluent are needed. Systems that are installed when the soil is dry may not function properly when the water table rises.

In table 6 the soils are rated according to their limitations to use as disposal fields for septic tanks, and the chief limitations are listed. Before a site is selected as a disposal field, the soil should be closely examined. Important characteristics that affect the functioning of disposal fields are water table, hazard of flooding, depth to bedrock or underlying material, soil texture and permeability, and slope.

If ground water rises to the level of the subsurface tile in the filtering field, the soil is so saturated that it will not take liquid sewage, or effluent, from the septic tank. The effluent may rise to the surface of the ground, give off ill-smelling odor, and endanger health. During the wettest periods, the water table should be at least 4 feet below the surface in a subsurface filter field and 4 feet below the floor of a seepage pit (*3*). Generally, well-drained soils are satisfactory for these disposal systems and poorly drained soils are not.

A disposal system for septic tanks should never be on a flood plain or near a stream that is likely to flood. In many areas, local regulations require that the filter field be located at least 50 feet from a stream, lake, open ditch, or other water course into which unfiltered and contaminated effluent might enter and spread (*3*).

Bedrock should be at least 4 feet below the bottom of the trenches, the floor of the seepage bed, or the bottom of a seepage pit so that there is enough soil to filter and purify the effluent (*3*). Even more depth is needed if the domestic water supply comes from wells and the bedrock is limestone. Limestone has many cracks, and unfiltered water may seep into the domestic water supply if the soil is not deep enough. Also, a depth greater than 4 feet is needed if the underlying material is sand and gravel. A disposal system works very well in a sandy soil, but where the supply of domestic water comes from a shallow source, effluent may contaminate the water.

The rate effluent moves through a soil depends partly on the texture of the subsoil and underlying material. Water moves faster through coarse-textured sandy and gravelly soils than through fine-textured clayey soils. Knowing the kind of clay is important, for certain kinds of clay swell when they are wet and slow the movement of effluent. These kinds of clays reduce the efficiency of the filtering field. The shrink-swell potential of all the soils is listed in table 5. In an effective system, the permeability of the soil should be moderate to rapid and the rate of percolation should be at least 1 inch per hour. The soil should be tested if there is any doubt about the percolation rate (*3*).

If other characteristics of a soil are favorable for the functioning of filter fields, slopes up to 10 percent are satisfactory. Filter beds are easier to construct and maintain in level areas or on gentle slopes than they are in steeper areas. In steeper areas the effluent may follow the natural drainage lines through the soil or seep out to the surface before it is properly filtered. Tile lines for the system should be placed on the contour to assist in filtering the effluent.

In table 6 the limitations of the soils to use as disposal systems are rated slight for the Camden, Ockley, Rodman, and some Fox soils. These soils are well drained and permeable or very permeable, and their water table is not close to the surface. The Hennepin soil also has slight limitations, but it is steep, and the filtering field should be placed on the contour. The Celina soils and some Miami soils have moderate limitations because their subsoil is moderately slow in permeability. The Blount, Crosby, Homer, Morley, and Sleeth soils have a seasonally high water table and slow to moderately slow permeability. They need drainage to be suitable for filter fields. For the Miami and Homer soils that have a limestone substratum, limitations to use as filter fields are severe because the limestone occurs at only 18 to 42 inches below the surface.

Brookston, Kokomo, Mahalasville, Pewamo, and Westland soils occur in depressions and are very poorly drained. They have very severe or severe limitations as filter fields. In addition to being very poorly drained, some Mahalasville soils have limestone only 18 to 42 inches from the surface, and some Westland soils are underlain by sand and gravel at 24 to 42 inches.

Because the Genesee, Eel, Ross, Shoals, and Sloan soils are subject to periodic flooding and have a seasonally high water table, their limitations to use as filter fields are severe or very severe.

The Washtenaw soil has very severe limitations because, in addition to its high water table and susceptibility to flooding and ponding, alluvium is likely to be washed in. The Carlisle, Edwards, and Linwood soils have very severe limitations because of their muck, high water table, and susceptibility to flooding. The peat or muck underlying the Wallkill soil severely limits it for use as disposal fields. Clay pits are very severely limited because of their position and their clay. For Gravel pits and Made land, the site should be investigated before a disposal field is planned.

Before designing and constructing a disposal system for septic tanks, one should become familiar with the regulations, requirements for a permit, and inspection systems, as well as the penalties that local authorities might impose for infractions. The city and county planning commission, the local board of health, the agricultural extension agent, and State and Federal departments of health can offer help (*2*, *3*, *4*, *5*, and *17*).

BUILDING SITES

It is important to know the soil and slope before constructing any kind of residential or industrial building, particularly where basements are to be constructed. On soils that have a seasonally high water table, subsurface drainage is needed to make the soils suitable as sites for buildings. If the water table is close to the surface most of the year, the construction of basements is especially difficult. Also, the danger of periodic flooding should be considered before any kind of construction is started. If a basement is to be constructed where limestone is close to the surface, the removal of the limestone will add to the cost.

Good surface or subsurface drainage is needed to avoid accumulation of water near the buildings. Some slope is desirable, but runoff from higher places may require that the excess water be diverted away from the buildings. In steeper areas measures to stabilize banks and buildings may be needed.

Table 6 rates and lists limitations to the use of the soils in the county as building sites. These ratings, however, do not eliminate the need for an inspection at the site. Limitations are rated as slight, moderate, severe, or very severe. These ratings are for homes on lots of less than one acre, shopping centers, apartments, and community centers. In rating the soils, drainage, suitability for basements, and slope or topography were considered.

Both surface and subsurface drainage were considered. A soil that has a permanently high water table requires a different kind of drainage than a soil having a seasonally high water table, and soils in rolling areas require still another kind of drainage. Soils that are periodically wet or frequently flooded generally are not satisfactory as sites for buildings if basements are to be constructed. More suitable are soils that have a water table at greater depth. Depressional areas are unfavorable as building sites because a large amount of fill is needed to improve drainage. Level areas are better. Much earth moving and grading is needed in strongly rolling areas.

Formation and Classification of Soils

In this section, the factors that affect the formation of soils are discussed and the soil series of the county are placed in the higher categories of soil classification. These categories are defined. Also described is each soil series and a profile representative of the series.

Factors of Soil Formation

When you drive through the countryside, perhaps you notice that soils differ. On one side of the road, dark-colored soils may occur in a depression, but farther along in a road cut, the soils may be lighter colored, higher, and have sand and gravel at a depth of about 42 inches or more. These differences in soils are a result of the different effects that parent material, time, topography, climate, and living organisms have had in the formation of the soils. All five of these factors are important in the genesis of every soil, but one factor may be more important than the others. In addition to these factors, man's past use has caused differences in the soils.

Parent material

The soils in Madison County formed mainly from two kinds of parent material: glacial till, or ice-laid material, and water-laid deposits, or alluvium. Loess, or wind-blown silt, and the underlying bedrock, which is largely limestone, have not had much influence in the development of the soils in the county.

Glaciation has been important in the formation of the soils in Madison County. Ice sheets, which were hundreds of miles long and thousands of feet thick, covered this county at least three times during periods called glacial stages. From oldest to youngest these glacial stages were the Kansan, Illinoian, and Wisconsin.

As the ice moved southward, it destroyed old hills and made new ones. Also, the ice and unconsolidated material buried valleys. A mantle of rock, sand, silt, and clay was left when the ice sheets melted or receded. This material, called glacial drift, is till or outwash. The till is compact heterogeneous sand, silt, clay, and gravel, and the outwash is water-laid deposits, mainly sand and gravel.

This county is in central Indiana in the relatively flat uplands called the Tipton Till Plain (*8*). Postglacial streams have cut valleys about 40 feet deep into the glacial drift that underlies this plain. The present landforms in the county are a result of glaciation and minor postglacial erosion. The underlying bedrock has had little effect on the present topography.

Except in the northeastern corner of the county, the soils formed from calcareous loam to light clay loam till. Miami soils developed on gentle slopes and on steep slopes that are along the breaks of rivers and streams. The Celina soils formed in gently sloping areas, and the Crosby soils formed in the nearly level areas. Hennepin soils developed on the steep to extremely steep slopes, but the dark-colored Brookston soils formed in depressions.

Soil-forming processes other than glaciation started to work after the glacier retreated northward. Later, however, ice again covered the northeastern corner of the county (*19*), and a low glacial ridge was formed. This ridge, called the Union City moraine, is about 30 feet higher than the area to the south (*7*). Alexandria is just southwest of this moraine, and Ridgon and Summitville are on it. The material of this moraine is soft clay from glacial lakes in the northern part of Indiana and Ohio, and the soils formed in the area contain more clay than the soils in the rest of the county. Morley soils developed in the gently sloping to strongly sloping areas, and the Blount soils formed in the nearly level to gently sloping areas. The dark-colored Pewamo soils developed in the depressions.

The soils that formed in water-laid material are variable. Some soils formed from outwash, which contains a considerable amount of sand and gravel. The outwash was deposited by melt water when the glacier retreated. Different kinds of soils formed in the broad, shallow valleys that cross the southern half of the county in a northeast-southwest direction. Glacial streams cut these valleys, and the rapidly flowing water carried along assorted material. Anderson esker was formed just southwest of Anderson. It is a ridge of gravel and sand that parallels State Route 9. Eskers commonly occur in sloughs. Fall Creek and the White River were subglacial streams that deposited the sand and gravel now forming the terraces along those streams.

The Ockley, Sleeth, and Westland soils and the Kokomo soils that have a gravelly substratum were derived partly from underlying sand and gravel, but their surface layer appears to have been derived from finer textured silty material. The Fox and Homer soils and the moderately deep Westland soils are 24 to 45 inches deep over outwash material. The Fox soils developed on small isolated knolls, called kames, that occur in several parts of the county. These kames contain sand and gravel, and they are surrounded by areas of till. Fox soils that have a till substratum developed in places where the melt water deposited only a smear of outwash material over the till. As shallow streams decreased in size, local ponding occurred in places and the organic Carlisle, Linwood, and Edwards soils developed.

Only silt and sand were deposited where the water from the glacier decreased in velocity. Developed on this silt and sand were the Camden and Mahalasville soils, the Sleeth soils that have a loamy substratum, and the Kokomo soils that have a stratified substratum. Some of these soils occur in the northwestern part of the county, just north of Elwood and southwest of the Union City moraine, where the topography is nearly level. In this area, the Mahalasville soils and the Kokomo soils that have a stratified substratum occur in depressions and the Sleeth soils that have a loamy substratum are in slightly higher areas.

On the present flood plains are the Genesee, Eel, Shoals, and Sloan soils. These are young soils formed in alluvium. They receive fresh deposits of alluvium during the frequent floods.

A dry period probably occurred after the glacier retreated, for 0 to 18 inches of loess covers the soils on uplands as well as some of the older soils on outwash. In most places, however, this loess is not deep enough to have had much influence on the formation of the soils.

Limestone, shale, and sandstone crop out in places, especially along the larger streams of the county. These rocks also have been exposed in several quarries. In other places limestone is close to the surface, but it is covered with glacial drift. Soils that formed in these places are Homer silt loam, limestone substratum, and Mahalasville silty clay loam, limestone substratum.

Time

The length of time that soil material remains in place, and is acted on by the soil-forming processes, largely determines whether a soil is fully developed or mature, or is undeveloped or young. Alluvial soils are young and show little or no profile development because fresh material is deposited periodically. Soils of this kind in the county are in the Genesee, Ross, Eel, and Shoals series. Some soils on steep slopes are immature because geologic erosion removes the soil material as fast as it is formed. The Rodman soils are of this kind.

Mature soils have well-developed A and B horizons that were produced by the natural processes of soil formation. The Miami, Celina, and Crosby soils, which were derived from Wisconsin till, have strong differentiating horizons and are leached of carbonates to a depth of 24 to 42 inches. The Morley and Blount soils were also derived from Wisconsin till, but this till was laid down in a later advance of the Wisconsin ice sheet. The A and B horizons of Morley and Blount soils are well developed, but carbonates are leached to a depth of only 20 to 40 inches.

Topography

Topography, or relief, has affected the drainage and development of the soils in Madison County. Relief influences soil formation by affecting internal drainage, runoff, depth of the water table, leaching, and accumulation or removal of organic matter. Generally, soils on the steeper slopes are not so strongly developed as are soils in more nearly level areas.

Because of differences in relief, mainly through its effect on drainage, different kinds of soils develop from the same kind of parent material. In the Miami catena, the Miami, Celina, Crosby, and Brookston soils formed from the same kind of parent material. The Crosby soils formed on level to nearly level topography, are somewhat poorly drained, have slow permeability, and have a gray mottled subsoil. The Celina soils formed on gently sloping topography, are moderately well drained, are yellowish brown and mottled in the subsoil, and have moderate permeability. Miami soils generally formed in gently sloping, sloping, or strongly sloping areas, are well drained, are yellowish brown to brown, and have moderate permeability. Brookston soils generally formed in depressions and are very poorly drained, dark colored, and slowly permeable.

Climate

Climate influences vegetation, mineralization, rate of weathering, and the formation of soil structure. In this county, summers are hot and humid, winters are cold, and precipitation totals about 37 inches each year. The rainfall is well distributed throughout the year, but is slightly greater in spring and summer than in fall and winter. Water from the heavy rainfall has leached plant nutrients from the surface and has kept free calcium carbonate from accumulating. Since the climate is uniform throughout the county, it is not a major factor causing differences among the soils.

Living organisms

Plants and animals are active in soil formation. Native vegetation is most effective, but other forms of life in and on the soil are also important.

In Madison County, most of the soils formed under a deciduous forest that consisted mainly of elm, maple, ash, oak, hickory, and poplar. In wooded areas a thin layer of forest litter and leaf mold covers the soil. This layer is acted on by micro-organisms, earthworms, and other forms of life and by direct chemical action. As the organic material decays, it releases organic acids that make the slowly soluble mineral materials more soluble. The rate of decay depends on climate, especially temperature and amount of moisture. The organic layer in dry wooded areas is thin, but that in swampy areas is thick. In swampy areas the vegetation consisted of trees, swamp grasses, and sedges. Because these areas were wet most of the time, organic matter accumulated instead of decaying or oxidizing.

Activity of man

Man changed the soils as he settled the county and cleared and cultivated areas of it. Cultivation changes the soils by making the sloping areas more susceptible to erosion, which removes topsoil, organic matter, and plant nutrients. In eroded areas the surface soil is hard, cloddy,

and sticky instead of soft, friable, and easy to work, as it was before erosion. By draining the dark-colored soils in depressions, man has improved aeration in the subsoil and the oxidizing of some minerals. If soils are plowed when they are wet, the original friable surface soil becomes hard and cloddy. Soils are also changed by changing the natural flow of water by means of diversions or other structures.

In this county areas mapped as Made land, Clay pits, and Gravel pits have been greatly changed by man. The development of the Washtenaw and Wallkill soils may be partly the result of man's activity. Recent alluvium or colluvium is on the surface of these soils, and it is underlain by the original black mineral soil or by muck.

Classification of Soils

Soils can be classified in a number of ways, depending on the purpose of the classification. They are placed in narrow classes to facilitate the organization and application of knowledge about their use and management on farms and fields (*14*). They can be placed in broad classes to facilitate study and comparison of large areas such as countries and continents.

Soils are placed in six categories in the system of classification that has been followed in the United States (*12*). Beginning at the top, these categories are order, suborder, great soil group, family, series, and type.

Each of these categories consists of a number of classes at the same level. The classes are few and broad in the highest category, whereas they are many and narrow in the lowest category. In the highest category the soils are placed in three orders, whereas thousands of soil types are recognized in the lowest category.

Among the six categories, those of order, great soil group, series, and type have been used most. The suborder and family categories have never been fully developed and therefore are seldom used. Attention has been given largely to the classification of soils by soil series, soil types, and phases of soil types. These categories are discussed in the section "How This Survey Was Made."

The classes in the highest category of the classification system are the zonal, intrazonal, and azonal. Each of these orders is represented in Madison County by one or more great soil groups, which in turn, represent one or more soil series. Some of these series do not fit the central concept of a great soil group and are intergrades to another great soil group. The soil series in the county are classified into the following orders and great soil groups.

ZONAL SOILS:	
Gray-Brown Podzolic soils:	
Central concept	Camden, Celina, Fox, Miami, Morley, and Ockley.
Intergrading toward Low-Humic Gley soils.	Blount, Crosby, Homer, and Sleeth.
INTRAZONAL SOILS:	
Humic Gley soils:	
Central concept	Brookston, Kokomo, Pewamo, Mahalasville, and Westland.
Intergrading toward Alluvial soils.	Sloan.
Bog soils:	
Central concept	Carlisle, Edwards, and Linwood.
Brown Forest soils:	
Intergrading toward Regosols.	Rodman.
AZONAL SOILS:	
Alluvial soils:	
Central concept	Eel, Genesee, Ross, and Washtenaw.
Intergrading toward Bog soils.	Wallkill.
Intergrading toward Low-Humic Gley soils.	Shoals.
Regosols:	
Intergrading toward Gray-Brown Podzolic soils.	Hennepin.

Zonal order

Zonal soils have characteristics that reflect the influence of the active factors of soil genesis—climate and living organisms. The profiles of these soils have well-differentiated horizons. The soils formed in materials that have been in place for a long time, are intermediate in physical and chemical composition, and are not subject to extremes in drainage or topography. In this county the only zonal soils are in the Gray-Brown Podzolic great soil group, but some of the soils in this group intergrade toward Low-Humic Gley soils.

GRAY-BROWN PODZOLIC SOILS

The Gray-Brown Podzolic soils have formed under a deciduous forest in a humid, temperate climate. They have well-developed horizons and are well drained to somewhat poorly drained.

In their virgin condition, Gray-Brown Podzolic soils have a thin O2 horizon that consists of organic material and an organic-mineral A1 horizon. The A2 horizon, which is light colored and leached, is underlain by a brown illuvial B horizon. The B horizon is normally finer textured than the A1 or C horizon. The O2 horizon is high in organic matter and soluble salts. It is less acid than the A1 or A2 horizon. Normally the A1 horizon is dark colored because organic matter has been mixed into the mineral material. Structure is generally granular. The A2 horizon is lighter colored, coarser textured, higher in silica, and lower in sesquioxides than the B horizon. It has been leached of soluble bases and is acid. In many places the A2 horizon has platy structure. The B horizon is normally brown and has blocky structure. It contains more clay than the A or C horizon.

The soils in this county that fit the central concept of Gray-Brown Podzolic soils are the well drained Camden, Fox, Miami, Morley, and Ockley soils and the moderately well drained Celina soils. The well-drained soils are in nearly level to steep areas, where they developed in different kinds of parent material. The moderately well drained Celina soils are in nearly level areas, where they developed in loamy till.

The Blount, Crosby, Homer, and Sleeth soils are Gray-Brown Podzolic soils that intergrade toward Low-Humic Gley soils. These soils are somewhat poorly drained. They have major characteristics like those of representative Gray-Brown Podzolic soils, but they are intergrades toward Low-Humic Gley soils because their B horizon is somewhat gleyed. These soils developed in nearly level or gently sloping areas. Surface drainage is slow or very slow, and the soils are saturated during much of the year.

Intrazonal order

Intrazonal soils have genetically related horizons that reflect a dominating influence of some local factor of relief of parent material over the normal influences of climate and vegetation. Like the zonal soils, intrazonal soils formed from materials that have been in place for a long time. The materials, however, may be extreme in nature; that is, they may be very fine textured or highly calcareous. Or the soils may develop where parent material is not extreme but drainage is restricted by the level topography. In Madison County the great soil groups in the intrazonal order are the Humic Gley, Bog, and Brown Forest.

HUMIC GLEY SOILS

Humic Gley soils formed in depressions where water tends to accumulate and internal drainage is slow or very slow. The native vegetation was a swamp forest made up of water-tolerant trees, marsh grasses, and sedges.

These soils have a thick, black or very dark grayish-brown A horizon that has a high content of organic matter and is underlain by mineral layers showing effects of poor aeration. The B horizon is strongly gleyed. Gray colors predominate in the upper part of the B horizon, and yellowish-brown or grayish-brown mottles occur in the lower part. Cracks in this horizon are coated with organic-mineral colloids. The soluble carbonates have been leached out by drainage, but the exchange complex remains highly charged with bases.

The development of the soils in this group is dominated by the process of gleization. Excess moisture and restricted aeration influence the rate of production and decomposition of the organic material. Also, iron compounds are reduced and translocated in the profile.

Fitting the central concept of this great soil group are the Brookston, Kokomo, Pewamo, Mahalasville, and Westland soils. The Brookston, Kokomo, and Pewamo soils formed in areas of till, and the Mahalasville and Westland soils formed on terraces.

The Sloan soils are Humic Gley soils that intergrade toward Alluvial soils because they have medium-textured alluvium over a weakly developed, gleyed B horizon. The Sloan soils formed in depressions or in broad level areas where water tends to pond.

BOG SOILS

Bog soils developed from accumulations of swamp or marsh vegetation in areas that are generally wet. They developed under a humid or subhumid climate. These soils occur in the depressions of till plains, terraces, and bottom lands.

Bog soils consists of brown, dark-brown, or black peat or muck over mineral material. The depth to the mineral material varies. The soils consist of partly decayed remains of plants that have been partly preserved in places that remain saturated.

In this county the Carlisle, Edwards, and Linwood soils are in this great soil group, and they fit the central concept of the group.

BROWN FOREST SOILS

Brown Forest soils developed under deciduous forest in parent material that was relatively rich in bases, especially calcium. These soils have dark-brown A and B horizons. The A horizon is relatively high in organic matter and is darker colored than the B horizon. The entire profile is neutral or slightly acid and contains a large amount of exchangeable calcium.

None of the soils in Madison County fit the central concept of this great soil group, but Rodman soils have weak horizonation and are intergrades toward Regosols. Rodman soils formed in highly calcareous stratified sand and gravel.

Azonal order

The azonal order consists of soils that lack discernable, genetically related horizons because of youth, resistant parent material, or steep topography. Soils in this order may be forming in flood-plain material or in other recently deposited sediment that has not been in place long enough for the differentiation of horizons other than accumulation of some organic material in the surface layer. The lack of genetically related horizons may also be caused by parent material that is resistant to change or by erosion that washes away the soil as fast as it develops. In Madison County the great soil groups in the azonal order are the Alluvial and the Regosol.

ALLUVIAL SOILS

Alluvial soils formed from material transported by water and recently deposited on flood plains or foot slopes. These soils have had little or no profile development other than accumulation of organic matter in the top layer. In some places they receive fresh deposits of material during each flood, and in other places the floods remove part of the surface layer.

In this county the Genesee, Ross, Eel, and Washtenaw soils fit the central concept of this great soil group. These soils formed in neutral to calcareous material that washed from forested areas of Wisconsin glacial drift. The Genesee, Ross, and Eel soils are light brown to dark brown. The Genesee and Ross soils are well drained, and the Eel soils are moderately well drained. In the Washtenaw soils alluvial material has been deposited over a dark-colored, poorly drained mineral soil.

The Wallkill soils developed in recent alluvium underlain by peat or muck. They are poorly drained and occur in depressions that are ponded much of the year. Because of the poor drainage and the peat and muck, Wallkill soils are classified as Alluvial soils that intergrade toward Bog soils.

The main characteristics of Shoals soils are similar to those of Alluvial soils, but chiefly because of the gleyed

layers below the surface layer, Shoals soils intergrade toward Low-Humic Gley soils.

REGOSOLS

The Regosols are made up of unconsolidated or soft deposits that show little or no profile development. In this county there are no Regosols that fit the central concept of the great soil group, but the Hennepin soils have a weak textural B horizon and are Regosols that intergrade toward Gray-Brown Podzolic soils. Hennepin soils formed in highly calcareous loam to heavy clay loam till of Wisconsin age.

Soil Series in Madison County

This subsection describes the soil series of Madison County and, for each series, a profile that has been observed in a named location. In the descriptions of the profiles, the colors given are for moist soil. Other information about each series, and descriptions of the individual soils in the series, are in the section "Descriptions of the Soils."

Blount series

The Blount series consists of somewhat poorly drained Gray-Brown Podzolic soils that intergrade toward Low-Humic Gley soils. Blount soils develop in deposits of loess that range from 0 to 18 inches in thickness and are underlain by silty clay loam to clay loam till of Wisconsin age. The till is highly calcareous at a depth of 20 to 40 inches. The Blount soils developed under mixed deciduous forest consisting mainly of oak, hard maple, and hickory.

Blount soils, in contrast to the Crosby soils, have a heavy silty clay loam or silty clay B2 horizon. The B2 horizon of the Crosby soils is silty clay loam or clay loam. Blount soils developed in clay loam or silty clay loam till, but the Crosby soils developed in light clay loam to loam till.

Representative profile of Blount silt loam, 75 feet south of Summitville Clinic, in NE¼ sec. 29, T. 22 N., R. 8 E.; cultivated field:

Ap—0 to 6 inches, grayish-brown (10YR 5/2) to dark grayish-brown (10YR 4/2) silt loam; moderate, fine, granular structure; friable; slightly acid; abrupt, smooth boundary.

A2—6 to 9 inches, grayish-brown (10YR 5/2) silt loam; weak, thin, platy structure; friable; medium acid to strongly acid; clear, smooth boundary.

IIB1tg—9 to 13 inches, grayish-brown (10YR 5/2) to dark grayish-brown (10YR 4/2) heavy silt loam with many, medium, distinct mottles of yellowish brown (10YR 5/6); moderate, fine, subangular blocky structure; friable; medium acid to strongly acid; clear, wavy boundary.

IIB21tg—13 to 17 inches, dark-brown (10YR 4/3) to dark yellowish-brown (10YR 4/4) silty clay loam with many, medium, distinct mottles of yellowish brown (10YR 5/6); moderate, medium, subangular blocky structure; firm; dark-gray (10YR 4/1) clay films on ped surfaces; medium acid to strongly acid; clear, wavy boundary.

IIB22g—17 to 26 inches, dark-brown (10YR 4/3) to dark yellowish-brown (10YR 4/4) silty clay with many, medium, distinct mottles of yellowish brown (10YR 5/6); moderate, medium, prismatic structure breaking to moderate, medium, angular blocky structure; firm; very dark grayish-brown (10YR 3/2) clay films on ped surfaces; medium acid to slightly acid; clear, wavy boundary.

IICg—26 to 35 inches +, grayish-brown (10YR 5/2) silty clay loam with many, medium, distinct mottles of yellowish brown (10YR 5/8); massive; firm; calcareous.

Silt loam is the only soil type of the Blount series mapped in this county. The A1 horizon is dark grayish brown in noncultivated areas. In cultivated fields, the Ap horizon ranges from dark grayish brown (10YR 4/2) to light brownish gray (10YR 6/2). The A1 and A2 horizons have been mixed in cultivated fields. The A horizon ranges from 7 to 10 inches in thickness. Mottling generally occurs at a depth of 8 to 13 inches. The B horizon is silty clay to silt loam. Depth to the calcareous till averages 28 inches but ranges from 20 to 40 inches.

Brookston series

The Brookston series consists of very poorly drained Humic Gley soils that developed in highly calcareous loam to light clay loam till of Wisconsin age. These soils have a loess cap as much as 18 inches thick in some places. They developed under mixed deciduous forest consisting of beech, soft maple, and other water-tolerant trees.

Brookston soils have a coarser textured Bg horizon than Pewamo soils. The C horizon of Brookston soils is loam to clay loam till, in contrast to the C horizon of clay loam or silty clay loam till in Pewamo soils.

Profile of Brookston silty clay loam, 50 feet south of the road and 300 feet east of the railroad track, in NE¼ sec. 36, T. 21 N., R. 7 E.; cultivated field:

Ap—0 to 9 inches, very dark gray (10YR 3/1) to very dark grayish-brown (10YR 3/2) silty clay loam; weak, fine, granular structure; friable; neutral; abrupt, smooth boundary.

A12—9 to 15 inches, very dark grayish-brown (10YR 3/2) to dark-gray (10YR 4/1) silty clay loam with few, medium, distinct mottles of dark yellowish brown (10YR 4/4); moderate, fine, angular blocky structure; friable; neutral; clear, wavy boundary.

B21g—15 to 34 inches, dark-gray (10YR 4/1) silty clay loam with common, medium, distinct mottles of yellowish brown (10YR 5/4); moderate, coarse, prismatic structure breaking to moderate, medium, angular blocky structure; firm; neutral; gradual, wavy boundary.

B22g—34 to 49 inches, grayish-brown (10YR 5/2) silty clay loam with many, coarse, distinct mottles of light yellowish brown (10YR 6/4) and brownish yellow (10YR 6/6); moderate, coarse, prismatic structure breaking to moderate, coarse, angular blocky structure; firm; neutral; abrupt, wavy boundary.

Cg—49 to 59 inches +, brown (10YR 5/3) loam till with many, coarse, distinct mottles of gray (10YR 5/1) and light yellowish brown (10YR 6/4); massive; friable; calcareous.

Silty clay loam is the dominant soil type of the Brookston series in the county, but some areas of Brookston silt loam are also mapped. The A horizon ranges from 8 to 15 inches in thickness, and the B horizon ranges from 34 to 45 inches. Limy till is at a depth of 42 to 60 inches. The Bg horizon ranges from clay loam to silty clay. In places along the larger drainageways, a few inches of sand or gravel are above the calcareous loam till. The C horizon is loam, silt loam, or light clay loam.

Camden series

The Camden series consists of well-drained Gray-Brown Podzolic soils that developed in silty or loamy outwash underlain by stratified calcareous sand and silt containing some gravel and clay of Wisconsin age. The calcareous sand and silt occur at a depth of 42 to 60 inches or more. The Camden soils developed under mixed deciduous forest.

Camden soils have less gravel in the lower subsoil than Ockley soils, and they are underlain by stratified sand and

silt instead of gravel and sand, as are the Ockley soils. Camden soils are similar to the Fox soils, which developed in sand and gravel instead of stratified sand and silt.

Representative profile of Camden silt loam, in SW¼ SW¼ sec. 17, T. 22 N., R. 8 E.; on west side of old pit:

O2—1 inch to 0, forest litter and grass roots.

A1—0 to 4 inches, very dark grayish-brown (10YR 3/2) to dark grayish-brown (10YR 4/2) silt loam; moderate, medium, granular structure; friable; neutral; abrupt, wavy boundary.

A2—4 to 12 inches, dark grayish-brown (10YR 4/2) silt loam; moderate, thin, platy structure; friable; medium acid; clear, wavy boundary.

B1t—12 to 17 inches, brown (10YR 4/3) to dark-brown (10YR 3/3) heavy silt loam; moderate, medium, subangular blocky structure; friable; slightly acid; clear, wavy boundary.

B21t—17 to 30 inches, brown (10YR 4/3) silty clay loam; moderate, medium, prismatic structure breaking to fine, subangular blocky structure; firm; medium acid to strongly acid; clear, wavy boundary.

IIB22t—30 to 44 inches, dark yellowish-brown (10YR 4/4) clay loam; moderate, medium, prismatic structure breaking to moderate, medium, angular blocky structure; friable; medium acid; gradual, wavy boundary.

IIC—44 to 66 inches +, dark yellowish-brown (10YR 4/4) stratified layers of loamy sand, sandy loam, sandy clay loam, fine sand, and silt; single grain to massive; loose to friable; neutral in the upper part, calcareous in lower part.

Silt loam is the only soil type of the Camden series mapped in this county. The silty cap is as much as 30 inches thick and is thickest in the nearly level areas. In many cultivated areas the plow layer is a dark brown (10YR 3/3). The B horizon ranges from silty clay loam to silt loam. In some places Camden soils are underlain by thick layers of calcareous sand, and in others the underlying material is silt.

Carlisle series

The Carlisle series consists of Bog soils developed in mixed organic materials that are the remains of woody plants and sedges. The organic material is more than 42 inches thick and is neutral or mildly alkaline.

The organic material in Carlisle soils is thicker than that in Linwood and Edwards soils.

Representative profile of Carlisle muck, one-half mile south of the radio tower and 20 feet south of the lane, in SW¼NW¼ sec. 35, T. 19 N., R. 7 E.; cultivated field:

O1—0 to 28 inches, black (10YR 2/1) muck; weak, medium, granular structure; friable; neutral; gradual, wavy boundary.

O2—28 to 36 inches, black (10YR 2/1) to very dark brown (10YR 2/2) muck or disintegrated peat; mildly alkaline; gradual, irregular boundary.

O3—36 to 42 inches +, black (10YR 2/1) muck mixed with dark-brown (10YR 3/3) somewhat fibrous and woody peat; weak, thick, platy structure; mildly alkaline.

The chief range in the characteristics of Carlisle soils is in the amount of peat in the profile. The O1 horizon ranges from black (10YR 2/1) to very dark brown (10 YR 2/2); the O2 horizon ranges from black (10YR 2/1) to very dark brown (10YR 2/2) or dark reddish brown (5YR 2/2); and the O3 horizon ranges from black (10YR 2/1) to dark brown (10YR 3/3) or dark reddish brown (5YR 2/2).

Celina series

The Celina series consists of moderately well drained Gray-Brown Podzolic soils that developed in highly calcareous loam, silt loam, or light clay loam till of Wisconsin age. These soils have a mantle of loess 0 to 18 inches thick. The till is calcareous at a depth of 24 to 42 inches. These soils developed under mixed deciduous forest.

Celina soils have a coarser textured B2 horizon than Morley soils. The Celina soils developed dominantly from loam till, but Morley soils developed from clay loam or silty clay loam till.

Representative profile of Celina silt loam, NE¼NW¼ sec. 32, T. 19 N., R. 7 E.; wooded area:

A1—0 to 2 inches, dark grayish-brown (10YR 4/2) silt loam; moderate, fine, granular structure; friable; slightly acid; clear, smooth boundary.

A2—2 to 9 inches, grayish-brown (10YR 5/2) to pale-brown (10YR 6/3) silt loam; moderate, coarse, granular structure; friable; slightly acid; clear, smooth boundary.

B1—9 to 11 inches, brown (10YR 5/3) or yellowish-brown (10YR 5/4) silt loam; moderate, fine, subangular blocky structure; friable; medium acid; clear, smooth boundary.

IIB21t—11 to 21 inches, brown (10YR 4/3) or dark yellowish-brown (10YR 4/4) silty clay loam or clay loam; moderate, medium, subangular blocky structure; firm; strongly acid; clear, wavy boundary.

IIB22t—21 to 27 inches, dark yellowish-brown (10YR 3/4) silty clay loam or clay loam with common, fine, distinct mottles of yellowish brown (10YR 5/4) and light yellowish brown (10YR 6/4); moderate, medium, subangular blocky structure; firm; slightly acid to neutral; abrupt, irregular boundary.

IIC—27 to 42 inches +, yellowish-brown (10YR 5/6) and brownish-yellow (10YR 6/6) loam till with common, medium, distinct mottles of very pale brown (10YR 7/3); massive; friable; calcareous.

Silt loam is the only soil type of the Celina series mapped in this county. In most places the loess cap ranges from 9 to 18 inches in thickness. Depth to mottling ranges from 18 to 30 inches. This depth is 18 inches in areas where the Celina soils grade to the somewhat poorly drained Crosby soils, but it is about 30 inches where Celina soils grade to the well-drained Miami soils. The lower boundary of the B22 horizon is irregular; tongues of this horizon extend into the C horizon. In small areas the calcareous till occurs at a depth of less than 24 inches. The C horizon is silt loam or light clay loam in some areas.

Crosby series

The Crosby series consists of somewhat poorly drained Gray-Brown Podzolic soils that intergrade toward Low-Humic Grey soils. Crosby soils developed in deposits of loess that are as much as 18 inches thick and are underlain by loam, silt loam, or light clay loam till of Wisconsin age. The till is at a depth of 24 to 42 inches and is highly calcareous. These soils developed under mixed deciduous forest.

Crosby soils have a coarser textured Bg horizon and C horizon than Blount soils.

Representative profile of Crosby silt loam, in SW¼ sec. 16, T. 19 N., R. 7 E.; cultivated field:

Ap—0 to 7 inches, dark grayish-brown (10YR 4/2) silt loam; weak, medium, granular structure; friable; medium acid; abrupt, smooth boundary.

A2—7 to 10 inches, brown (10YR 5/3) to yellowish-brown (10-YR 5/4) silt loam with common, fine, distinct mottles of pale brown (10YR 6/3); weak, thin, platy structure; friable; medium acid; clear, wavy boundary.

IIB1tg—10 to 15 inches, brown (10YR 5/3) to light brownish-gray (10YR 6/2) heavy silt loam with many, fine, distinct mottles of yellowish brown (10YR 5/6); moderate, fine, prismatic structure breaking to moderate, fine, subangular blocky structure; firm; medium acid; clear, wavy boundary.

IIB21tg—15 to 23 inches, yellowish-brown (10YR 5/6) or dark yellowish-brown (10YR 4/4) silty clay loam or clay loam with many, medium, distinct mottles of light brownish gray (10YR 6/2) to grayish brown (10YR 5/2); moderate, medium, prismatic structure breaking to moderate, medium, subangular blocky structure; firm; medium acid; clear, wavy boundary.

IIB22tg—23 to 34 inches, dark grayish-brown (10YR 4/2) silty clay loam or clay loam with many, medium, distinct mottles of yellowish brown (10YR 5/6); moderate, coarse, prismatic structure breaking to moderate, medium, subangular blocky structure; firm; slightly acid; clear, wavy boundary.

IICg—34 to 42 inches +, yellowish-brown (10YR 5/4) loam with many, coarse, distinct mottles of grayish brown (10YR 5/2), brown (10YR 5/3), and light yellowish brown (10YR 6/4); massive; friable; calcareous.

Silt loam is the only soil type of the Crosby series mapped in this county. In areas where Crosby soils grade to the Brookston soils, the surface layer is normally darker colored than that described. Depth to mottling ranges from 8 to 16 inches. In some areas a few inches of sand and gravel are above the calcareous till.

Edwards series

The Edwards series consists of Bog soils that developed in well decomposed or moderately well decomposed remains of plants. The organic layer, 12 to 42 inches thick, is underlain by calcareous marl. Edwards soils developed under mixed grasses, sedges, and shrubs.

Edwards soils have a different kind of underlying material than have Linwood soils and have a thinner organic layer than Carlisle soils.

Representative profile of Edwards muck, 80 feet south of the road, 80 feet east of the fence, and 500 feet west of the Anderson esker, in NW¼NW¼ sec. 2, T. 18 N., R. 7 E.; cultivated field:

O1—0 to 24 inches, black (10YR 2/1) well-decomposed muck; weak, fine, granular structure; friable; neutral; abrupt, wavy boundary.

IIC—24 to 34 inches +, light-gray (10YR 6/1 to 7/1) marl; massive; calcareous; many small shells.

Muck is the only soil type of the Edwards series mapped in Madison County. The amount of peat varies from none to layers 14 inches thick. Also variable are the purity and the color of the marl.

Eel series

The Eel series consists of moderately well drained Alluvial soils that developed in alluvium washed from areas of highly calcareous Wisconsin drift. The profile is weakly developed. It is neutral or alkaline in the upper layers and calcareous at a depth of about 3 feet. These soils developed under mixed deciduous forest consisting of elm, poplar, sycamore, beech, and soft maple.

Representative profile, 50 feet east of Main Street Road, 75 feet southeast of a large tree, and 250 feet north of Fall Creek, in SE¼SE¼ sec. 12, T. 18 N., R. 7 E.; cultivated field:

Ap—0 to 10 inches, dark-brown (10YR 3/3) to very dark grayish-brown (10YR 3/2) silt loam; moderate, medium, granular structure; friable; neutral; abrupt, smooth boundary.

C1—10 to 24 inches, dark-brown (10YR 3/3) heavy silt loam; weak, subangular blocky structure; friable; neutral; gradual, wavy boundary.

C2g—24 to 42 inches +, grayish-brown (10YR 5/2) silt loam or loam with common, medium, distinct mottles of yellowish brown (10YR 5/4); massive; friable; mildly alkaline.

Silt loam is the only soil type of the Eel series mapped in this county. The surface layer ranges from dark grayish brown (10YR 4/2) to very dark grayish brown (10YR 3/2). The C1 horizon ranges from neutral to calcareous. Depth to mottling ranges from 18 to 30 inches. Thin lenses of sand occur in the C1 and C2 horizons in some areas. The C2g horizon ranges from silt loam to fine sandy loam.

Fox series

The Fox series consists of well-drained Gray-Brown Podzolic soils that developed in silty or loamy outwash material underlain by stratified calcareous gravel and sand at a depth of 24 to 42 inches. These soils developed under mixed deciduous forest.

Fox soils have a thinner solum than Ockley soils. Sand and gravel are nearer the surface in Fox soils than in the Ockley soils.

Representative profile of Fox silt loam, in NW¼NW¼ sec. 32, T. 21 N., R. 7 E.; edge of a gravel pit:

A1—0 to 4 inches, dark-brown (10YR 3/3) silt loam; weak, fine, granular structure; friable; neutral; clear, wavy boundary.

A21—4 to 7 inches, dark-brown (10YR 3/3) or dark yellowish-brown (10YR 3/4) silt loam; weak, very thin, platy structure; friable; neutral; clear, wavy boundary.

A22—7 to 12 inches, dark-brown (10YR 3/3) or brown (10YR 4/3) silt loam; weak, very fine, subangular blocky structure; friable; slightly acid; clear, smooth boundary.

B21t—12 to 21 inches, dark-brown (10YR 3/3) or dark yellowish-brown (10YR 3/4) light silty clay loam; moderate, fine, subangular blocky structure; firm; medium acid; gradual, wavy boundary.

IIB22t—21 to 31 inches, dark-brown (7.5YR 3/2) clay loam; moderate, medium, subangular blocky structure; firm; strongly acid; gradual, wavy boundary.

IIB23t—31 to 36 inches, dark reddish-brown (5YR 3/3) or dark-brown (7.5YR 3/2) sandy clay loam to clay loam; weak, coarse, subangular blocky structure; firm; neutral; abrupt, irregular boundary.

IIIC—36 to 44 inches +, brown (10YR 4/3) or dark yellowish-brown (10YR 4/4) stratified gravel and sand and tongues of material extending from the IIB23t horizon; single grain; loose; calcareous.

Silt loam is the most common soil type of the Fox series mapped in the county, but small areas of loam and fine sandy loam occur on narrow ridges or terraces in the valleys of the major streams. In some places loess caps these soils in a layer that is as much as 13 inches thick. The thickness of this cap depends on the steepness of slope and the degree of erosion. In some nearly level areas, the loess cap is thicker than the A horizon. The A horizon ranges from 9 to 12 inches in thickness. In severely eroded areas, the surface layer is silty clay loam or clay loam. The upper part of the B horizon is silty clay loam in areas where the loess cap is thicker than the A horizon. The lower part of the B horizon is light clay loam, gravelly clay loam, or sandy clay loam. The thickness of the B horizon ranges from 12 to 30 inches, depending on the steepness of slope and the degree of erosion. The B23t horizon ranges from 3 to 8 inches in thickness. In some

areas the underlying sand and gravel is not thick and is underlain by calcareous till.

Genesee series

The Genesee series consists of well-drained Alluvial soils that developed in alluvium washed from areas of highly calcareous Wisconsin drift. The profile of these soils is weakly developed. It is neutral or calcareous at the surface and in the subsoil. These soils developed under mixed deciduous forest consisting of elm, sycamore, and ash.

Genesee soils have lighter colored surface and subsurface horizons than Ross soils.

Representative profile of Genesee silt loam, 50 feet east of the bridge, in SW¼NW¼ sec. 16, T. 18 N., R. 8 E.; cultivated field:

Ap—0 to 8 inches, dark-brown (10YR 3/3) silt loam; moderate, fine, granular structure; friable; neutral; clear, smooth boundary.
C—8 to 42 inches +, brown (10YR 4/3) silt loam; weak, fine, subangular blocky structure; friable; neutral.

Silt loam is the only soil type of the Genesee series mapped in this county, but areas occur that have a silty clay loam, loam, or fine sandy loam surface layer. The surface layer ranges from very dark gray (10YR 3/1) to dark yellowish brown (10YR 3/4). The C horizon ranges from very dark grayish brown (10YR 3/2) to dark yellowish brown (10YR 4/4). The areas that border Eel soils have faint mottling below a depth of 30 inches. Strata of loam, fine sandy loam, and fine sand occur in the profile, especially in the C horizon.

Hennepin series

The Hennepin series consists of the well-drained Regosols that intergrade toward Gray-Brown Podzolic soils. Hennepin soils developed in calcareous loam, silt loam, or light clay loam till that is now at a depth of 3 to 12 inches. These soils developed under hardwood forest.

Unlike Miami soils, Hennepin soils have only a faint or no B horizon and have calcareous till at a depth of less than 12 inches. Hennepin soils are underlain by till, whereas Rodman soils are underlain by sand and gravel.

Representative profile of Hennepin silt loam, 300 feet southeast of the Gun Barn, in NE¼NE¼ sec. 5, T. 19 N., R. 7 E.; steep, wooded slope:

A1—0 to 5 inches, very dark grayish-brown (10YR 3/2) silt loam; moderate, medium, granular structure; friable; neutral; abrupt, irregular boundary.
C1—5 to 15 inches, dark-brown (10YR 3/3) to dark yellowish-brown (10YR 3/4) silt loam or loam till; moderate, fine, subangular blocky structure; friable; calcareous; clear, wavy boundary.
C2—15 to 30 inches +, dark yellowish-brown (10YR 4/4) loam till; moderate, medium, subangular blocky structure; friable to firm; calcareous.

Silt loam is the most common soil type of the Hennepin series in this county, but a few small areas of loam occur on narrow escarpments along the major streams. The A horizon ranges from 3 to 6 inches in thickness and from very dark grayish brown (10YR 3/2) to dark yellowish brown (10YR 4/4) in color. In some places a thin light silty clay loam B horizon occurs, but in no place is it more than 4 inches thick.

Homer series

The Homer series consists of somewhat poorly drained Gray-Brown Podzolic soils that intergrade toward Low-Humic Gley soils. Homer soils developed in silty and loamy outwash over highly calcareous stratified sand and gravel at a depth of 24 to 42 inches. The Homer soils developed under mixed deciduous forest.

Homer soils have a thinner solum than Sleeth soils and are underlain by calcareous sand and gravel at a depth of less than 42 inches. Sand and gravel underlie the Sleeth soils at a depth of 42 to 70 inches or more.

Representative profile of Homer silt loam, 200 feet north of the large barn and 12 feet west of the north-south fence, in SW¼NW¼ sec. 35, T. 19 N., R. 7 E.; cultivated field:

Ap—0 to 7 inches, dark grayish-brown (10YR 4/2) silt loam; moderate, medium, granular structure; friable; neutral; abrupt, smooth boundary.
A2—7 to 10 inches, dark grayish-brown (10YR 4/2) or yellowish-brown (10YR 5/4) silt loam; weak, thick, platy structure; friable; neutral; abrupt, smooth boundary.
B1—10 to 13 inches, yellowish-brown (10YR 5/4) heavy silt loam with few, fine, faint mottles of yellowish brown (10YR 5/8); weak, very thick, platy structure; friable; medium acid; abrupt, wavy boundary.
B21tg—13 to 18 inches, yellowish-brown (10YR 5/4) silty clay loam with common, fine, faint and distinct mottles of yellowish brown (10YR 5/8) and light brownish gray (10YR 6/2); moderate, fine, subangular blocky structure; firm; medium acid; clear, wavy boundary.
IIB22tg—18 to 26 inches, grayish-brown (10YR 5/2) gravelly clay loam with many, medium, distinct mottles of brown (7.5YR 4/4); moderate, medium, subangular blocky structure; firm; medium acid; gradual, wavy boundary.
IIB23tg—26 to 36 inches, grayish-brown (10YR 5/2) sandy clay loam with many, medium, distinct mottles of yellowish brown (10YR 5/8); massive; firm; neutral; abrupt, wavy boundary.
IIIC—36 to 48 inches +, grayish-brown (10YR 5/2) stratified sand and gravel with many, medium, distinct mottles of light yellowish brown (10YR 6/4); single grain: loose; calcareous.

Silt loam is the only soil type of the Homer series mapped in this county. The A horizon ranges from dark grayish brown (10YR 4/2) to light brownish gray (10YR 6/2). The B horizon ranges from 18 to 32 inches in thickness. Depth to mottling is 8 to 15 inches, and depth to the calcareous sand and gravel is 24 to 42 inches.

Kokomo series

The Kokomo series consists of very dark colored, very poorly drained Humic Gley soils that developed in highly calcareous loam to light clay loam till of Wisconsin age. In some places these soils have a loess cap as much as 18 inches thick. Kokomo soils developed under marsh grasses and mixed deciduous forest consisting of beech, elm, soft maple, and other water-tolerant trees.

Kokomo soils have more organic matter in the surface layer and upper part of the subsoil than Brookston soils. The Kokomo soils also have a thicker A horizon than Brookston soils, and the upper Bg horizon of the Kokomo soils is predominantly gray rather than mottled as it is in Brookston soils.

Representative profile of Kokomo silty clay loam, in NW¼NE¼ sec. 35, T. 24 N., R. 8 E.; cultivated field:

Ap—0 to 6 inches, very dark brown (10YR 2/2) silty clay loam; weak, fine, granular structure; friable; neutral; abrupt, smooth boundary.

A12—6 to 12 inches, very dark brown (10YR 2/2) to very dark gray (10YR 3/1) silty clay loam; weak, medium, granular structure; firm; neutral; clear, smooth boundary.

A13—12 to 19 inches, very dark brown (10YR 2/2) to very dark grayish-brown (10YR 3/2) silty clay loam; weak, fine, subangular blocky structure; friable; neutral; gradual, wavy boundary.

B21g—19 to 26 inches, dark-gray (10YR 4/1) silty clay loam with many, fine mottles of yellowish brown (10YR 5/4) in the lower part; moderate, medium, prismatic structure breaking to moderate, medium, subangular blocky structure; firm; neutral; gradual, irregular boundary.

B22g—26 to 46 inches, gray (10YR 5/1) silty clay loam with many, fine, distinct mottles of yellowish brown (10YR 5/8) and light brownish gray (10YR 6/2); moderate, coarse, prismatic structure breaking to moderate, medium, angular blocky structure; firm; neutral; gradual, irregular boundary.

IICg—46 to 56 inches +, gray (10YR 5/1) loam, silt loam, or light clay loam till with many, coarse, distinct mottles of light yellowish brown (10YR 6/4); massive; friable; calcareous.

Kokomo silty clay loam, mucky silty clay loam, and mucky silt loam are mapped in the county. In a few places sand or gravel, a few inches thick, is above the calcareous till. The A horizon ranges from black (10YR 2/1) to very dark brown (10YR 2/2) in color and from 18 to 24 inches in thickness. The B horizon is a silty clay loam, clay loam, or silty clay and ranges from 27 to 52 inches in thickness. Depth to calcareous loam to light clay loam till ranges from 42 to 70 inches. In some places the substratum is stratified silt and fine sand, and in other places it is stratified sand and gravel.

Linwood series

The Linwood series consists of Bog soils that developed in well decomposed to moderately well decomposed woody and fibrous plants. These soils have an organic layer that is 12 to 42 inches thick, and this layer is underlain by neutral to calcareous loam, silt loam, and silt. These soils developed under mixed forest, grasses, and sedges.

Loamy calcareous material underlies Linwood soils, whereas Edwards soils are underlain by calcareous gray marl. The organic material of the Linwood soils is thinner than that of the Carlisle soils.

Representative profile of Linwood muck, 500 feet east of the barn and 30 feet north of the lane, in SW¼ sec. 35, T. 19 N., R. 7 E.; cultivated field:

O1—0 to 9 inches, black (10YR 2/1) muck; moderate, very fine, granular structure; friable; slightly acid to medium acid; clear, smooth boundary.

O2—9 to 20 inches, black (10YR 2/1) muck; weak, fine, subangular blocky structure; friable; slightly acid to medium acid; abrupt, wavy boundary.

IIC1—20 to 45 inches, dark grayish-brown (10YR 4/2) silt loam; massive; friable; neutral; abrupt, wavy boundary.

IIIC2—45 to 52 inches +, pale-brown (10YR 6/3) gravel; calcareous.

The organic layers range from 12 to 42 inches in thickness. Layers of peat 2 to 4 inches thick occur in some places. The underlying loam, silt loam, or silt ranges from neutral to calcareous. Calcareous gravel occurs at depths below 42 inches in some places.

Mahalasville series

The Mahalasville series consists of very poorly drained Humic Gley soils. Mahalasville soils developed in silty or loamy outwash that, at a depth of 42 to 60 inches or more, is underlain by stratified fine sand and silt containing a small amount of gravel. These soils developed under mixed deciduous forest.

Mahalasville soils are underlain by calcareous stratified sand and silt at a depth of 42 to 60 inches, whereas Westland soils are underlain by calcareous stratified sand and gravel at 42 to 70 inches. Brookston soils are underlain by calcareous till.

Profile of Mahalasville silty clay loam, in NW¼NE¼ sec. 7, T. 22 N., R. 8 E.; cultivated field:

A1p—0 to 7 inches, very dark gray (10YR 3/1) silty clay loam; moderate, medium, granular structure; friable; neutral; abrupt, smooth boundary.

A12—7 to 12 inches, very dark gray (10YR 3/1) silty clay loam; moderate, medium, subangular blocky structure; firm; neutral; clear, wavy boundary.

B21g—12 to 18 inches, gray (5Y 5/1) silty clay loam with common, fine, prominent mottles of reddish brown (5YR 5/4); moderate, fine, angular blocky structure; firm; neutral; gradual, irregular boundary.

B22g—18 to 39 inches, gray (5Y 5/1) silty clay loam with common, medium, prominent mottles of brown (7.5Y 4/4); weak, medium, prismatic structure breaking to moderate, medium, angular blocky structure; firm; neutral; clear, wavy boundary.

IIB3g—39 to 44 inches, light-gray (N 6/0) silt with many, medium, prominent mottles of yellowish brown (10YR 5/8); weak, coarse, prismatic structure; firm; mildly alkaline; abrupt, wavy boundary.

IIIC—44 to 50 inches +, light-gray (N 6/0) stratified sand and silt with common, coarse, distinct mottles of yellowish brown (10YR 5/8) to brownish yellow (10YR 6/6); massive; friable; calcareous.

Silty clay loam is the dominant soil type of the Mahalasville series mapped in the county, but some areas of Mahalasville silt loam are mapped. The surface layer ranges from very dark gray to black in color and from 9 to 16 inches in thickness. The B horizon ranges from silty clay to silt. Below the B horizon are thin layers of fine sand and silt and a small amount of gravel and clay. The depth to calcareous material ranges from 42 to 60 inches. In some places, mainly south of Perkinsville and near Pendleton, limestone bedrock occurs at a depth of 18 to 42 inches.

Miami series

The Miami series consists of well-drained Gray-Brown Podzolic soils that developed in deposits of loess that range from 0 to 18 inches in thickness and are underlain by light clay loam till of Wisconsin age. The till is calcareous at a depth of 24 to 42 inches. These soils developed under hardwood forest.

The Miami soils have less clay in the B horizon than the Morley soils and, unlike those soils, developed in loam to light clay loam till. The Morley soils developed in clay loam and silty clay loam till. The Miami soils are similar to Fox soils that have a till substratum, but they are not so well oxidized and are not so red in the B horizon.

Representative profile of Miami silt loam, in SW¼ NW¼ sec. 5, T. 19 N., R. 7 E.; cultivated field:

Ap—0 to 7 inches, brown (10YR 4/3) to dark yellowish-brown (10YR 4/4) silt loam; weak, medium, granular structure; friable; neutral; abrupt, smooth boundary.

A2—7 to 10 inches, brown (10YR 5/3) to yellowish-brown (10YR 5/4) silt loam; weak, coarse, granular structure; friable; slightly acid; clear, wavy boundary.

IIB21t—10 to 16 inches, dark-brown (10YR 4/3 to 3/3) clay loam; weak to moderate, medium and fine, subangular blocky structure; friable; strongly acid; clear, wavy boundary.

IIB22t—16 to 26 inches, dark-brown (7.5YR 3/2) silty clay loam to clay loam; moderate, medium, subangular blocky structure; firm; medium acid; gradual, irregular boundary.

IIC—26 to 36 inches +, brown (10YR 5/3) to yellowish-brown (10YR 5/4) loam till; massive; friable; calcareous.

Silt loam is the dominant soil type of the Miami series mapped in the county, but areas that have a varied texture in the surface layer are mapped as Miami soils. The surface layer ranges from yellowish brown in cultivated fields to very dark grayish brown in wooded areas. In areas where the loess cap is thickest, the A horizon and the upper part of the B horizon developed entirely in loess. In nearly level areas, the A horizon ranges from 9 to 12 inches in thickness. In severely eroded areas, the surface layer is light silty clay loam to clay loam. The B horizon ranges from 16 to 30 inches in thickness and is silty clay loam or clay loam. The C horizon is till that ranges from loam to silt loam or light clay loam. In some places along Prairie Creek and along the White River southeast of Perkinsville, limestone bedrock occurs at a depth of 18 to 42 inches.

Morley series

The Morley series consists of moderately well drained to well drained Gray-Brown Podzolic soils that developed in deposits of loess that are 0 to 18 inches thick and are underlain by silty clay loam to clay loam till of Wisconsin age. The till is highly calcareous at a depth of 20 to 40 inches. These soils developed under hardwood forest.

Morley soils have more clay in the B horizon than the Miami soils, for they developed in clay loam or silty clay loam till, whereas Miami soils developed in loam to light clay loam till.

Representative profile of Morley silt loam, near a trench silo, in NW¼NE¼ sec. 18, T. 21 N., R. 8 E.; cultivated field:

Ap—0 to 7 inches, grayish-brown (10YR 5/2) silt loam; moderate, medium, platy structure and moderate, medium, granular structure; soft; friable; slightly acid; abrupt, smooth boundary.

B21t—7 to 10 inches, brown (10YR 5/3) to yellowish-brown (10YR 5/4) silty clay loam; moderate, fine, angular blocky structure; firm; medium acid; clear, wavy boundary.

IIB22t—10 to 15 inches, dark-brown (10YR 4/3) silty clay; moderate, fine and medium, angular blocky structure; firm; very dark grayish-brown (10YR 3/2) clay films; medium acid to strongly acid; gradual, wavy boundary.

IIB23t—15 to 26 inches, dark yellowish-brown (10YR 4/4) silty clay loam; moderate, coarse, prismatic structure breaking to moderate, medium and coarse, angular blocky structure; firm; dark-brown (7.5YR 3/2) clay films; medium acid in upper part, slightly acid to neutral in lower part; abrupt, irregular boundary.

IIC—26 to 36 inches +, yellowish-brown (10YR 5/4) to light yellowish-brown (10YR 6/4) silty clay loam or clay loam; massive; firm; calcareous.

Silt loam is the dominant soil type of the Morley series mapped in this county, but areas that have a varied texture in the surface layer are mapped as Morley soils. The surface layer ranges from very dark grayish brown in undisturbed areas to grayish brown in cultivated areas. On gentle slopes the loess cap is thicker than the A horizon in some places. The A horizon ranges from 0 to 10 inches in thickness. It is thickest in gently sloping areas and is thinnest in rolling, severely eroded areas. The surface layer is clay loam or silty clay loam in severely eroded areas. The B horizon ranges from 13 to 26 inches in thickness and from heavy silty clay loam to silty clay in texture. In some gently sloping areas mottles occur in the lower part of the B horizon.

Ockley series

The Ockley series consists of well-drained Gray-Brown Podzolic soils that developed on outwash terraces capped with silt in most places. The outwash is of Wisconsin age and is silty or loamy. It is underlain by highly calcareous stratified sand and gravel at a depth of 42 to 70 inches or more. These soils developed under deciduous forest.

Ockley soils have a thicker solum than the Fox soils and contain more silt in their A horizon and upper B horizon. Also, the depth to sand and gravel is only 24 to 42 inches in the Fox soils.

Representative profile, 1 mile east of Hamilton, 20 feet south of Eighth Street Road, and 30 feet west of a small barn, in SE¼SE¼ sec. 6, T. 19 N., R. 7 E.:

A1—0 to 3 inches, very dark grayish-brown (10YR 3/2) silt loam; moderate, medium, granular structure; friable; abundant roots; neutral; clear, smooth boundary.

A2—3 to 10 inches, brown (10YR 4/3) silt loam; moderate, thick, platy structure; friable; abundant roots; slightly acid; clear, smooth boundary.

B1—10 to 15 inches, brown (10YR 4/3) silt loam; moderate, medium, subangular blocky structure; friable; medium acid; clear, wavy boundary.

B21t—15 to 38 inches, brown (7.5YR 4/4) light silty clay loam; moderate, medium, subangular blocky structure; firm; strongly acid; diffuse, wavy boundary.

IIB22t—38 to 52 inches, dark-brown (7.5YR 3/2) gravelly clay loam; weak, coarse, subangular blocky structure; friable; slightly acid; abrupt, wavy boundary.

IIB3—52 to 60 inches, dark yellowish-brown (10YR 3/4) gravelly sandy loam; massive; friable; calcareous; abrupt, irregular boundary.

IIIC—60 to 68 inches +, brown (10YR 5/3) to light yellowish-brown (10YR 6/4) stratified sand and gravel; single grain; loose; calcareous.

Silt loam is the only soil type of the Ockley series mapped in this county, but small areas of Ockley loam also occur. The silt cap is as much as 3 feet thick and is thickest in nearly level areas. In cultivated areas the plow layer is brown to dark yellowish brown. The upper B horizon ranges from silty clay loam to silt loam, and the lower B horizon ranges from clay loam to gravelly clay loam. The B3 horizon does not occur in all areas. The B22t horizon ranges from dark reddish brown to dark yellowish brown. It is a few inches to a foot or more thick. Tongues from the B22t horizon extend into the sand and gravel in some areas. The depth to sand and gravel is shallowest in areas where Ockley soils grade to the Fox soils.

Pewamo series

The Pewamo series consists of very poorly drained Humic Gley soils. Pewamo soils developed in highly calcareous clay loam to silty clay loam Wisconsin till at a depth that is generally more than 42 inches. These soils developed under mixed deciduous forest consisting of beech, soft maple, elm, and other water-tolerant trees.

The Pewamo soils have finer textured Bg horizons than Brookston soils and developed in clay loam or silty clay loam till rather than loam to light clay loam till.

Representative profile of a Pewamo silty clay loam, 100 feet north of an open ditch and 0.3 mile east of the barn, in SW¼ sec. 13, T. 22 N., R. 7 E.; cultivated field:

Ap—0 to 8 inches, very dark gray (10YR 3/1) to black (10YR 2/1) silty clay loam speckled with yellowish brown (10YR 5/4); weak, medium, subangular blocky structure; friable; few roots; neutral; clear, smooth boundary.

A12—8 to 11 inches, very dark gray (10YR 3/1) silty clay loam; moderate, fine, angular blocky structure; firm; neutral; few roots; clear, smooth boundary.

B21g—11 to 20 inches, gray (5Y 5/1) silty clay loam with few, fine, distinct mottles of yellowish brown (10YR 5/6); moderate, fine, angular blocky structure; firm; neutral; clear, wavy boundary.

B22g—20 to 28 inches, gray (5Y 5/1) silty clay with many, medium, distinct mottles of yellowish brown (10YR 5/8); moderate, medium, angular blocky structure; firm; neutral; clear, wavy boundary.

B23g—28 to 48 inches, gray (5Y 5/1) silty clay with many, medium, distinct mottles of dark yellowish brown (10YR 4/4) and yellowish brown (10YR 5/6); moderate, coarse, prismatic structure; firm; neutral; clear, wavy boundary.

Cg—48 to 56 inches +, gray (5Y 5/1) clay loam or silty clay loam till with few, fine, distinct mottles of yellowish brown (10YR 5/6); massive; firm; calcareous.

Silty clay loam is the only soil type of the Pewamo series mapped in this county. The A horizon ranges from very dark grayish brown to black in color and from 8 to 15 inches in thickness. The Bg horizons range from silty clay loam to silty clay or clay loam. The B horizon is 34 to 45 inches thick. Depth to the calcareous clay loam to silty clay loam till is 34 to 60 inches.

Rodman series

The Rodman series consists of well-drained Brown Forest soils that intergrade toward Regosols. Rodman soils developed in highly calcareous stratified sand and gravel that are now at a depth of less than 12 inches. These soils developed under deciduous forest.

Rodman soils are underlain by gravel and sand, whereas the Hennepin are underlain by till.

Representative profile of Rodman silt loam, 150 feet south of a fence and 75 feet west of a fence, in NW¼SE¼ sec. 10, T. 18 N., R. 7 E.; very steep, wooded slope:

A1—0 to 3 inches, very dark grayish-brown (10YR 3/2) to dark-brown (10YR 3/3) silt loam; moderate, fine, granular structure; friable; neutral; abrupt, smooth boundary.

B2t—3 to 10 inches, dark reddish-brown (5YR 3/3) gravelly clay loam; weak, medium, subangular blocky structure; friable; neutral; abrupt, wavy boundary.

IIC—10 inches +, light yellowish-brown (10YR 6/4) and brown (10YR 5/3), stratified sand and gravel; single grain; loose; calcareous.

Silt loam is the only soil type of the Rodman series mapped in the county, but areas that have varied texture in the surface layer are mapped as Rodman soils. Rodman soils vary chiefly in thickness of the A horizon and the depth to sand and gravel. In some places a B horizon does not occur. On the steeper slopes, these soils are essentially skeletal and have much unweathered limy material on the surface. The surface layer ranges from a silt loam to gravelly clay loam. Erosion is slight to severe.

Ross series

The Ross series consists of well-drained, dark-colored Alluvial soils that developed in moderately coarse textured to fine-textured alluvium in areas of calcareous drift. These soils are neutral or calcareous throughout the profile. They developed under mixed deciduous forest of oak, ash, walnut, and sycamore.

Ross soils have a thicker and darker colored surface layer than the Genesee soils.

Representative profile of Ross silt loam, in Anderson at the north end of Henry Street, NE¼ sec. 11, T. 19 N., R. 7 E.; in cultivated field:

A1p—0 to 9 inches, very dark gray (10YR 3/1) to very dark brown (10YR 2/2) silt loam; weak, fine granular structure; friable; neutral; clear, smooth boundary.

A12—9 to 17 inches, very dark gray (10YR 3/1) to very dark brown (10YR 2/2) silt loam; weak, very fine, subangular blocky structure; friable; neutral; clear, smooth boundary.

A13—17 to 23 inches, very dark gray (10YR 3/1) loam; weak, very fine, subangular blocky structure; friable; neutral; abrupt, smooth boundary.

C1—23 to 38 inches, dark reddish-brown (5YR 3/3–3/4) sandy clay loam; massive; friable; calcareous.

IIIC2—38 to 42 inches +, pale-brown (10YR 6/3) stratified loam, silt, sand, and some gravel; massive; friable; calcareous.

Silt loam and loam are the soil types of the Ross series mapped in this county, but there are small areas where the surface layer is finer textured than silt loam. Where Ross soils grade to Genesee soils, the surface layer is lighter colored than that described and the A1 horizon is thinner than normal. In some places the surface layer is slightly calcareous. The C horizon ranges from sandy clay loam to fine sandy loam. In some areas calcareous loose sand and gravel occur in the lower part of the profile. Ross silt loam shows slight development of a B horizon in some places. Small shells are in the solum in many places.

Shoals series

The Shoals series consists of somewhat poorly drained Alluvial soils that intergrade toward Low-Humic Gley soils. Shoals soils developed in alluvium washed from areas of highly calcareous Wisconsin drift. The profile is weakly developed and is neutral to alkaline in the upper layers and calcareous at a depth of 3 feet or less. These soils developed under mixed deciduous forest consisting of elm, poplar, sycamore, beech, and soft maple.

Representative profile of Shoals silt loam, 30 feet northeast of a large dead honey-locust tree and 200 feet south of a steep break in a valley one-eighth of a mile north of Frankton, in SE¼NW¼ sec. 31, T. 21 N., R. 7 E.; noncultivated area:

A1—0 to 6 inches, dark grayish-brown (10YR 4/2) to very dark grayish-brown (10YR 3/2) silt loam; weak, medium, granular structure; friable; many roots; neutral; abrupt, wavy boundary.

C1g—6 to 12 inches, dark grayish-brown (10YR 4/2) to brown (10YR 5/3) silt loam with common, medium, distinct mottles of light gray (10YR 7/2) and brownish yellow (10YR 6/6); weak, thin, platy structure; friable; many roots; neutral; abrupt, smooth boundary.

C2g—12 to 28 inches, brown (10YR 5/3) to dark grayish-brown (10YR 4/2) silt loam with few, fine, faint mottles of dark yellowish brown (10YR 4/4); weak, medium, granular structure; friable; few roots; neutral; gradual, wavy boundary.

C3g—28 to 40 inches +, gray (10YR 5/1) to grayish-brown (10YR 5/2) silt loam with many, coarse, prominent mottles of reddish brown (5YR 4/4) ; weak, medium, subangular blocky structure; friable; few roots; calcareous.

Silt loam is the only soil type of the Shoals series mapped in this county. The surface layer ranges from very dark grayish brown (10YR 3/2) in wooded areas or pasture to grayish brown (10YR 5/2) in cultivated areas. The surface layer is neutral or mildly alkaline. In some places thin layers of loam occur at varying depths. Depth to calcareous material is variable. In many places gravel and sand occur below a deph of 4 or 5 feet.

Sleeth series

The Sleeth series consists of somewhat poorly drained Gray-Brown Podzolic soils that intergrade toward Low-Humic Gley soils. Sleeth soils developed on terraces of Wisconsin age in silty and loamy outwash over highly calcareous stratified sand and gravel. The sand and gravel are at a depth of 42 to 70 inches or more. Sleeth soils developed under mixed deciduous forest that includes beech, elm, and soft maple.

Sleeth soils are underlain by calcareous stratified sand and gravel at a depth of 42 to 70 inches, in contrast to the Homer soils, which are underlain by stratified sand and gravel at a depth of 24 to 42 inches.

Representative profile of Sleeth silt loam, 200 feet east of gravel pit and 400 feet west of old State Route 9, in NE¼SW¼ sec. 31, T. 20 N., R. 8 E.; cultivated field:

Ap—0 to 10 inches, very dark grayish-brown (10YR 3/2) silt loam; moderate, fine, granular structure; friable; few roots; neutral; clear, smooth boundary.

A2—10 to 16 inches, gray (10YR 5/1) silt loam with common, fine, distinct mottles of yellowish brown (10YR 5/8) ; weak, thin, platy structure; friable; few roots; medium acid to slightly acid; clear, smooth boundary.

B1tg—16 to 20 inches, gray (10YR 5/1) light silty clay loam with common, fine, distinct mottles of yellowish brown 10YR 5/8) ; moderate, medium, subangular blocky structure; friable; medium acid to strongly acid; clear, smooth boundary.

B21tg—20 to 24 inches, dark-gray (10YR 4/1) to gray (10YR 5/1) silty clay loam with common, medium, distinct mottles of yellowish brown (10YR 5/8) ; moderate, medium, subangular blocky structure; firm; medium acid to strongly acid; gradual, smooth boundary.

B22tg—24 to 38 inches, dark-gray (10YR 4/1) silty clay loam with many, medium, distinct mottles of yellowish brown (10YR 5/8) ; weak, coarse, subangular blocky structure; firm; medium acid to strongly acid; clear, wavy boundary.

IIB23tg—38 to 48 inches, dark-gray (N 4/0) clay loam with many, medium, distinct mottles of yellowish brown (10YR 5/8) ; massive; friable; slightly acid to neutral; abrupt, wavy boundary.

IIIC—48 to 60 inches +, gray (10YR 5/1) to dark-gray (10YR 4/1) gravel and sand; single grain; loose; calcareous.

Silt loam is the only soil type of the Sleeth series mapped in this county. The A horizon ranges from very dark grayish brown to light grayish brown in color and from 10 to 19 inches in thickness. The subsoil ranges from silty clay loam to clay loam in texture and from 32 to 62 inches in thickness. Depth to underlying calcareous sand and gravel ranges from 42 to 70 inches. Depth to sand and gravel is greatest in areas where Sleeth soils grade to Homer soils. In some places, principally in the northwestern part of the county and along the edges of stream valleys in other parts, the substratum is stratified silt and fine sand.

Sloan series

The Sloan series consists of very poorly drained Humic Gley soils that intergrade toward Alluvial soils. Sloan soils developed in alluvium washed from areas of highly calcareous Wisconsin drift. They have a weakly developed profile that is neutral to mildly alkaline in the upper layers and is calcareous at a depth of about 2 feet. These soils developed under swamp grasses and sedges and elm, poplar, sycamore, beech, and other water-tolerant, deciduous trees.

Representative profile of Sloan silt loam, 1,000 feet south of the house, 200 feet west of the lane, and 100 feet north of a row of trees, in NW¼SE¼ sec. 17, T. 19 N., R. 8 E.; noncultivated area:

A11—0 to 7 inches, very dark gray (10YR 3/1) silt loam with few, fine, faint mottles of dark yellowish brown (10YR 3/4) ; weak, fine, subangular blocky structure breaking to moderate, very fine, granular structure; friable; abundant roots; neutral; clear, smooth boundary.

A12—7 to 17 inches, very dark gray (10YR 3/1) silt loam with common, fine, faint mottles of dark yellowish brown (10YR 3/4) ; weak, medium, subangular blocky structure breaking to moderate, very fine, granular structure; friable; many roots; neutral; clear, wavy boundary.

Bg—17 to 37 inches, very dark gray (N 3/0) light silty clay loam with few, fine, distinct mottles of dark yellowish brown (10YR 3/4) and pale brown (10YR 6/3) ; weak, medium, subangular blocky structure; friable; few roots; mildly alkaline; clear, wavy boundary.

C1g—37 to 47 inches, dark-gray (N 4/0) silty clay loam with many, medium, distinct mottles of yellowish brown (10YR 5/6) and pale brown (10YR 6/3) ; massive; friable; few roots; mildly alkaline; clear, wavy boundary.

IIC2g—47 to 52 inches +, dark-gray (10YR 4/1) silt loam with common, medium, distinct mottles of pale brown (10YR 6/3) and yellowish brown (10YR 5/6) ; massive; friable; few roots; mildly alkaline.

Silt loam is the only soil type of the Sloan series mapped in this county, but small areas having a silty clay loam surface layer also occur. The surface layer ranges from very dark brown (10YR 2/2) to gray (10YR 5/1) and is lighter colored in areas where the alluvium is most recent. In some places the soils are calcareous at the surface. Depth to mottling ranges from 7 to 24 inches. The texture and structure of the various layers differ from place to place. In some places calcareous sand and gravel occur below a depth of 34 inches.

Wallkill series

The Wallkill series consists of very poorly drained Alluvial soils that intergrade toward Bog soils. Wallkill soils developed in 10 to 40 inches of recent alluvium that washed from Wisconsin drift and is underlain by muck or peat. The original soil was a muck formed from mixed trees, grasses, and sedges.

Wallkill soils developed in recent alluvium over muck or peat, whereas Washtenaw soils developed over a dark-colored mineral soil.

Representative profile of a Wallkill silt loam, 40 feet north of the road and 200 feet east of State Route 9, in SW¼SW¼ sec. 7, T. 20 N., R. 8 E.; cultivated field:

Ap—0 to 6 inches, very dark gray (10YR 3/1) heavy silt loam; weak, medium, granular structure; friable; many roots; neutral; abrupt, smooth boundary.

A12—6 to 18 inches, very dark gray (10YR 3/1) heavy silt loam; weak, thick, platy structure; friable; neutral; abrupt, smooth boundary.
Ob1—18 to 38 inches, black (10YR 2/1) muck; weak, fine, granular structure; friable; neutral; gradual, wavy boundary.
Ob2—38 to 48 inches +, black (10YR 2/1) muck with few, fine, distinct specks of dark yellowish-brown (10YR 4/4) peat; neutral.

Only Wallkill complex is mapped in this county. It ranges from very dark gray (10YR 3/1) to dark grayish brown (10YR 4/2). The thickness of the recent alluvium ranges from 10 to 40 inches. In some places there are thin layers of silty clay above the organic soil. Underlying the muck or peat in some places are calcareous stratified silt, sand, gravel, and small amounts of clay. The depth to calcareous material ranges from 40 to 65 inches.

Washtenaw series

The Washtenaw series consists of very poorly drained Alluvial soils that developed in 10 to 40 inches of recent alluvium over dark-colored soils in depressions of the uplands or terraces. Because their parent material was deposited recently, the natural vegetation varies.

The parent material of Washtenaw soils was deposited over mineral soil, whereas that of the Wallkill soils was deposited over muck or peat. In Washtenaw soils 10 to 40 inches of alluvium overlies a buried soil, but in the Westland, Mahalasville, Brookston, and Pewamo soils this alluvium does not occur or occurs in only small amounts.

Representative profile of Washtenaw silt loam, 200 feet west of State Route 9 along Mud Creek, in NE¼NE¼ sec. 36, T. 22 N., R. 7 E.; cultivated field:

Ap—0 to 8 inches, very dark grayish-brown (10YR 3/2) silt loam; moderate, fine, granular structure; friable; neutral; clear, smooth boundary.
A12—8 to 19 inches, very dark grayish-brown (10YR 3/2) silt loam; weak, coarse, subangular blocky structure; friable; neutral; abrupt, wavy boundary.
Ab—19 to 31 inches, very dark gray (10YR 3/1) silty clay loam; moderate, medium, angular blocky structure; firm; neutral; clear, irregular boundary.
B21gb—31 to 48 inches, dark-gray (10YR 4/1) silty clay loam or clay loam with common, fine, distinct mottles of dark yellowish brown (10YR 4/4); weak, coarse, prismatic structure breaking to moderate, medium, angular blocky structure; firm; neutral; clear, irregular boundary.
B22gb—48 to 68 inches, dark-gray (10YR 4/1) silty clay loam or clay loam with common, medium, distinct mottles of yellowish brown (10YR 5/6) and light brownish gray (10YR 6/2); moderate, coarse, prismatic structure; firm; mildly alkaline; abrupt, wavy boundary.
IICgb—68 to 72 inches +, gray (10YR 5/1) stratified silt and sand with mottles of light yellowish brown (10YR 6/4) and yellowish brown (10YR 5/6); massive; firm; calcareous.

Only Washtenaw complex is mapped in this county. The recent alluvium ranges from grayish brown (10YR 5/2) to very dark grayish brown (10YR 3/2). It ranges from 10 to 40 inches in thickness but is generally about 20 inches thick. The subsoil ranges from silty clay loam to clay loam. The underlying material is calcareous loam to silty clay loam till or stratified silt, sand, and gravel. Depth to the underlying calcareous material varies but is more than 42 inches.

Westland series

The Westland series consists of dark-colored, very poorly drained Humic Gley soils. Westland soils developed in silty and fine loamy materials laid down by water over stratified calcareous sand and gravel on terraces of Wisconsin outwash. The sand and gravel occur at a depth of 42 to 70 inches or more. These soils developed under mixed deciduous forest made up mainly of beech, elm, and soft maple.

The Westland soils are underlain by layers of sand and gravel, whereas the Mahalasville soils are under layers of silt and fine sand.

Representative profile of Westland silty clay loam, 20 feet north of the lifting station for the Alexandria sewage-disposal system, east of State Route 9, in SW¼SW¼ sec. 18, T. 21 N., R. 8 E.; noncultivated area:

A1—0 to 6 inches, very dark brown (10YR 2/2) silty clay loam; moderate, fine, subangular blocky structure; friable; many roots; neutral; clear, wavy boundary.
A12—6 to 14 inches, very dark brown (10YR 2/2) to very dark grayish-brown (10YR 3/2) silty clay loam; moderate, fine, subangular blocky structure; friable; many roots; neutral; clear, wavy boundary.
B21g—14 to 28 inches, dark-gray (10YR 4/1) silty clay loam with few, fine, distinct mottles of yellowish brown (10YR 5/6) and brown (7.5YR 4/4); moderate, medium, prismatic structure breaking readily to moderate, medium, angular blocky structure; firm; few roots; neutral; clear, wavy boundary.
B22g—28 to 40 inches, dark-gray (10YR 4/1) silty clay loam with many, medium, distinct mottles of yellowish brown (10YR 5/8) and brown (7.5YR 4/4); moderate, medium, prismatic structure breaking readily to moderate, medium, angular blocky structure; firm; few roots; neutral; clear, smooth boundary.
IIB3g—40 to 49 inches, dark grayish-brown (10YR 4/2) sandy clay loam with many, medium, distinct mottles of yellowish brown (10YR 5/8); massive; friable; few roots; neutral; abrupt, wavy boundary.
IIIC—49 to 60 inches +, gray (10YR 6/1) to light yellowish-brown (10YR 6/4) stratified sand and gravel; single grain; loose; calcareous.

Silty clay loam is the only soil type of the Westland series mapped in this county, but the surface layer is silt loam in some places. The surface layer ranges from very dark brown to black in color and from 8 to 14 inches in thickness. The A horizon is thickest where these soils grade to Kokomo soils. The subsoil ranges from silty clay loam to clay loam in texture and from 34 to 55 inches in thickness. Depth to calcareous stratified sand and gravel ranges from 24 to 70 inches. Washtenaw soils have a thicker solum in areas where they are near Ockley soils than they have in areas where they are near Fox soils.

Additional Information About the County

This section provides information that will interest people who are not familiar with the county. It discusses physiography, climate, agriculture, and other subjects of general interest.

Physiography, Relief, and Drainage

Madison County is situated in the Tipton Till Plain (*8*), which occupies most of the central part of Indiana and forms part of the Central Lowland Province of the United States (*6*). This whole area is characterized by only small differences in relief, for it has been only slightly changed

by the post-Wisconsin streams. Glaciation, not the underlying bedrock, was the principal factor responsible for the present landforms.

In this county, the topography is rather flat except along the breaks of the streams. For example, the Union City moraine, which is in the northeast corner, has gentle slopes instead of steep ones.

For more information about topography, glaciation, and underlying bedrock of Madison County see the subsection "Factors of Soil Formation."

The highest point in the county is in the southeast corner and has an elevation of approximately 1,010 feet. The highest elevation in Anderson is about 874 feet, in Alexandria is about 855 feet, and in Elwood is about 862 feet. The lowest elevation in the county is in the southwest corner and is approximately 800 feet.

The West Fork of the White River cuts the county approximately in half. Except for Indian Creek and Little Kilbuck Creek, which empty into the river in this county, the White River receives the greater part of its drainage water from other counties. Big Kilbuck Creek rises in Delaware County and drains the eastern part of Madison County. Pipe Creek, which also rises in Delaware County, drains the northern and northeastern parts of the county. Pipe Creek, after flowing through Alexandria and Frankton, empties into the White River about a mile west of the Madison County line. Duck Creek starts from the level black land as a series of ditches and drains the northwest corner of the county. It flows through Elwood and flows into the White River in Hamilton County. In the southern part of the county, Fall Creek, which rises in Henry County, flows nearly parallel to Lick Creek and then joins that stream in the southwestern part of the county. A few hundred acres in the extreme northern part of the county are drained to the north by waterways that flow into upper tributaries of the Wabash River. Also, in the extreme southeast corner of the county, a few hundred acres are drained by waterways that flow into tributaries of the East Fork of the White River. All of these streams in the county, except those along the northern county line, flow towards the southwest.

Climate of the County [6]

The climate of Madison County is continental. The temperature varies widely from summer to winter, but precipitation is consistent through all seasons, compared to large regions of the world that have a dry season. No one month of the year has an average of less than 2 inches of rain. Although evaporation exceeds rainfall in summer, the rainfall in spring and summer usually compensates for the loss of moisture, particularly on agricultural soils that have a high moisture capacity. The temperature varies widely because the county is several hundred miles from the oceans and this distance moderates their influences. Also, solar radiation is about three times greater in summer than in winter. Because the Rocky Mountains usually bar the flow of air from the Pacific Ocean, cold air from the north enters the county at various times in all seasons. The data in this section are from observations that were taken at Anderson.

In most years the rainfall in Madison County is adequate for farming, but in summer when crops use much water and evaporation is high, a period of low rainfall may cause a reduction in crop yields. Nevertheless, a complete failure of crops is not known. The medium-textured soils on uplands generally have a good capacity for holding moisture, and the moisture supplied bridges the periods when it does not rain. Frequent, heavy rains in spring, however, sometimes delay farmwork, and a late start in planting increases the risk of crop loss in fall. If the first freezing temperature is early, some crops may not have time to mature.

Temperature and the length of the frost-free season are important to the agriculture of the county. The warm or hot summers are excellent for corn and similar crops when moisture is adequate. Usually there are enough days between the last freezing temperature in spring and the first in fall for the crops grown in the county to mature, but occasionally tender crops are killed by a freeze unusually late in spring or unusually early in fall. The following list gives the probability, in percent, for a frost-free season of stated length at Anderson.

Probability in percent:	*Number of frost-free days*
90	156
75	166
50	178
25	190
10	200

Based on past records, the shortest growing season at Anderson is 138 days and the longest is 205 days. The average length of the growing season is 178 days.

Also computed from the records at Anderson, and given in table 7, is the chance, in percent, that specified temperatures will occur after listed dates in spring or before listed dates in fall. These dates differ for different parts of the county because of elevation and landforms. For the readings from which the data in table 7 were computed, the thermometers are about 5 feet above the ground and in a standard shelter.

In a 40-year period at Anderson, the earliest freezing temperature recorded in spring was on April 2, 1929, and the latest was on May 24, 1925. In this 40-year period the earliest freezing temperature in fall was on September 21, 1956, and the latest was on November 13, 1946.

The cold temperatures of winter may damage fruit, forage, and other crops. In some winters the freezing and thawing of the soils may heave, or lift, some of the young plants of a forage or a small grain crop. Snow cover is welcome, for it protects these crops from temperatures below zero. Temperatures have dropped as low as $-20°$ F. in the county. At this temperature, fruit trees are usually killed, but a high frequency of this killing can be avoided by choosing orchard sites with care and by avoiding pockets in low ground where cold air concentrates. Also, by choosing a favorable direction of slope, solar radiation is a low temperature deterrent. Table 8 summarizes, by month, some of the variations of temperature, precipitation, and snowfall that may be expected.

In winter the snow on the ground often protects soils from deep and frequent freezing, and it also serves as a cover that protects forage crops and winter grains from the cold. Snowfall varies greatly in winter; single months in some years have had as much snow as has fallen all year at other times.

[6] By L. A. SCHAAL, State climatologist, U.S. Weather Bureau.

TABLE 7.—*Chance of last critical temperatures in spring and first in fall at Anderson* [1]

Temperature	Chance of occurrence after date in spring					Chance of occurrence before date in fall				
	90 percent	75 percent	50 percent [2]	25 percent	10 percent	10 percent	25 percent	50 percent [2]	75 percent	90 percent
°F										
40	May 4	May 10	May 17	May 24	May 30	Sept. 16	Sept. 22	Sept. 28	Oct. 4	Oct. 10
36	Apr. 23	Apr. 29	May 6	May 13	May 19	Sept. 25	Oct. 1	Oct. 7	Oct. 13	Oct. 19
32	Apr. 11	Apr. 18	Apr. 26	May 4	May 11	Oct. 4	Oct. 11	Oct. 20	Oct. 29	Nov. 5
28	Mar. 24	Apr. 1	Apr. 9	Apr. 17	Apr. 25	Oct. 19	Oct. 25	Nov. 2	Nov. 10	Nov. 16
24	Mar. 9	Mar. 18	Mar. 28	Apr. 7	Apr. 16	Oct. 30	Nov. 6	Nov. 13	Nov. 20	Nov. 27
20	Feb. 26	Mar. 6	Mar. 16	Mar. 26	Apr. 3	Nov. 4	Nov. 14	Nov. 26	Dec. 8	Dec. 18
16	Feb. 12	Feb. 22	Mar. 5	Mar. 16	Mar. 26	Nov. 14	Nov. 25	Dec. 7	Dec. 19	Dec. 30

[1] Official readings are taken from thermometers located about 5 feet above ground in a standard thermometer shelter. Since temperatures on a windless, cloudless night are often lower below the shelter or in a crop, some probabilities are shown for in-shelter above freezing temperatures. Temperatures below freezing are pertinent relative to hardy crops. From "Risks of Freezing Temperatures—Spring and Fall in Indiana" (*9*).

[2] Dates in this column are average dates.

Winds of high velocity seldom occur in the county, and they do little damage to property or crops. Wind erosion is slight because the soil moisture is adequate most of the time. Extremely high winds may come from intense low pressure centers moving through or near Madison County, or they may come from severe local thunderstorms. These thunderstorms are brief and localized, but their winds are of higher velocity than those caused by low pressure centers. In a 43-year period, only ten tornadoes have been reported (*15*). Because tornadoes are small and infrequent, casualties and loss of property from them are unlikely. In all seasons except winter, winds blow from the southwest most of the time. In winter, winds from the west or northwest may be more frequent.

Relative humidity affects farming indirectly. On most days relative humidity reaches nearly 100 percent when the temperature is lowest, usually just before sunrise. If 100 percent humidity is reached earlier, heavy dew or frost accumulates and delays some early morning farming operations. At other times high humidity is welcomed because it slows evaporation and lessens the loss of moisture. Humidity decreases as the day warms and on a typical summer afternoon is commonly 40 to 50 percent; it is 10 to 20 percent higher in winter. After a cold front passes, the humidity generally falls. Winds from the south bring higher humidity.

In Madison County local differences in climate exist because of differences in terrain, including slope, and in soil cover, soil moisture, soil color, and other factors. All of these factors should be considered when estimating the climate of a location so that a suitable kind of farming can be selected.

TABLE 8.—*Climate data (16)*

Month	Temperature							Precipitation					Number of days with—				
									One year in 10 will have—		Snow, sleet			Maximum temperature of—		Minimum temperature of—	
	Average daily maximum	Average daily minimum	Average maximum	Average minimum	Average	Highest	Lowest	Average total	Less than—	More than—	Average	Maximum	0.10 inch or more of precipitation	90° and above	32° and below	32° and below	0° and below
	°F.	°F.	°F.	°F.	°F.	°F.	°F.	*Inches*	*Inches*	*Inches*	*Inches*	*Inches*					
January	37	21	57	−2	29	69	−20	2.6	0.7	5.9	5.3	22	6	0	9	25	2
February	39	23	60	+1	31	72	−19	1.9	.6	3.4	4.5	20	4	0	6	22	1
March	51	31	72	+13	41	85	−6	3.4	1.6	6.3	3.2	17	7	0	2	18	(2)
April	63	41	81	25	52	90	18	3.6	1.9	5.9	.8	6	8	0	(2)	6	0
May	73	51	87	35	62	96	28	4.1	1.7	6.9	(1)	2	8	1	0	(2)	0
June	82	60	92	45	71	103	36	4.0	1.6	7.7	0	0	7	5	0	0	0
July	86	64	95	51	75	105	42	3.7	1.2	6.4	0	0	6	9	0	0	0
August	84	62	93	50	73	103	39	3.5	1.6	5.5	0	0	5	7	0	0	0
September	79	56	91	38	68	103	26	3.3	.8	6.4	0	0	6	3	0	(2)	0
October	67	45	83	28	56	92	15	2.6	.9	4.8	.1	2	5	(2)	0	3	0
November	52	34	71	15	43	81	−4	2.9	1.2	4.9	1.6	10	6	0	2	14	(2)
December	39	24	59	+2	32	68	−15	2.4	.6	4.2	4.8	18	5	0	8	23	1
Year	63	43	78	25	53	105	−20	38.0	30.4	45.8	20.3	22	73	25	27	111	4

[1] Trace.

[2] Less than one-half day.

Water Supply

Drinking water, mainly from wells, is in good supply for livestock and household use. The wells are shallow on the bottom lands and low terraces but are of varied depth on the higher terraces and uplands. The depth to water in the uplands depends on the thickness and composition of the till. Most of the water comes from gravel strata within the till. Numerous deep wells have been sunk to meet the needs of the larger cities. For example, Alexandria has five deep wells that average 280 feet in depth and can pump 1,180 gallons per minute. The normal rate of use in Alexandria is 826 gallons per minute. As population increases in the county, several communities are thinking of supplementing the deep wells by areas of surface storage (reservoirs).

Settlement and Population

When the first white settlers came to the area that is now Madison County, they found the Delaware and Miami Indians roaming the area. They also found evidence of an ancient people, the Mound Builders, who built mounds for defense and for religious use. Several well-preserved mounds left by these people can be seen at the Mounds State Park. The Delaware and Miami Indians remained in the area until after the Treaty of St. Marys was signed in 1818.

Most of the early settlers came from Virginia and Kentucky. Pendleton was the first town to be founded, and it was followed by Anderson and Chesterfield (*11*). The county seat was first at Pendleton, but it was moved to Anderson in 1828.

The population of Madison County grew slowly at first, but after the railroads were built between 1851 and 1891, population increased, and with this increase, agriculture and industry expanded. In 1960 the county had 125,819 people. Following are some of the main incorporated towns in the county and their population in 1960:

Alexandria	5,582
Anderson	49,061
Chesterfield	2,588
Elwood	11,793
Pendleton	2,472

Industry and Transportation

Many industries that used inexpensive natural gas were established in the numerous towns and cities of Madison County after the first natural gas wells were sunk in 1887. These communities flourished until the supply of gas was depleted and some of the industries closed. Industries that do not use local natural gas now operate in the larger cities. Gas from local wells is now chiefly used for domestic purposes by some of the farmers in the county. Industry, however, has expanded in this county. Some of the principal manufactures are automotive equipment and glass, metal, and clay products.

The county is well served by railroads and roads. Railroads that provide passenger or freight service are the New York Central, Pennsylvania, Norfolk and Western, and Central Indiana. Local and interstate buslines serve many communities. The roads include U.S. Highway No. 36, Interstate Highway No. 69, and several State highways. Most of the unpaved roads have hard gravel surfaces and are well maintained. Hauled on these railroads and roads are livestock, livestock products, and crops produced in the county.

Cultural Changes and Facilities

The cultural pattern of Madison County is changing to one of a modern, progressive, rural county that is rapidly urbanizing. People are moving into the rural areas and are commuting to the cities. Many people travel from these rural areas to their jobs in Anderson and in Indianapolis or Muncie out of the county. The farms are increasing in size but are operated by fewer people. Many farmers are working in the cities part time.

The one-room schoolhouse has been replaced by consolidated schools. A college is situated in Anderson, and several others are located in the larger cities in neighboring counties. Churches of many faiths are located in this county.

Agriculture

Madison County is important for farming, though there is a trend toward urbanization. Farming is generally of the cash grain-livestock type. The statistics given in this subsection are from the 1954 and 1959 Censuses of Agriculture.

In 1954, there were 241,160 acres in farms and 2,297 farms in the county, but by 1959 acreage in farms had increased to 246,700 acres and the number of farms had dropped to 2,059. During this 1954–59 period, the number of farms decreased 238, but a change in the definition of a farm accounted for 125 of this number. The average size of a farm was 105 acres in 1954 and 119.8 acres in 1959. Between 1954 and 1959, the value of the land and buildings on the average farm increased from $37,760 to $54,314. The average value of land per acre increased from $316 to $413.

As the number of farms decreased between 1954 and 1959, the number of full owners decreased from 1,361 to 1,162, but part owners increased from 438 to 474. In this period, managers of the farms reporting increased from 3 to 6, and the number of tenants decreased from 472 to 391.

Of the types of farms in the county in 1959, there were 731 miscellaneous and unclassified farms, 595 cash-grain farms, 516 livestock farms, 135 general farms, 75 dairy farms, 30 poultry farms, and 10 vegetable farms. The types of farms that showed the greatest change in number between 1954 and 1959 were miscellaneous and unclassified farms, from 511 to 731; livestock farms from 656 to 516; cash-grain farms from 815 to 595; and poultry farms from 80 to 30.

In 1959, 1,077 farmers worked off the farm. On 875 farms, the farm family earned other income that exceeded the value of the farm products sold.

Between 1954 and 1959, the amount of cropland harvested increased from 167,383 to 176,822 acres, and the cropland used only for pasture decreased from 26,359 to 18,400 acres. The other changes in land use during this period were not significant, though the area in woodland pastured fell from 14,604 acres to 11,349 acres.

Crops

Corn occupied the largest acreage of any crop in the county in 1954 and in 1959, but the acreage in soybeans was also extensive. Hay and small grain were also important, though the acreage in hay has decreased significantly since 1954. Table 9 gives the acreage of the principal crops in the county in 1954 and 1959.

TABLE 9.—*Acres of principal crops*

Crops	1954	1959
Corn for all purposes	65, 996	75, 288
Harvested for grain	64, 570	74, 081
Cut for silage	762	646
Hogged, grazed, or cut for fodder	664	561
Small grains threshed or combined:		
Wheat	15, 789	19, 512
Oats	22, 585	17, 763
Barley	66	242
Rye	734	496
Soybeans, all purposes	39, 647	45, 271
Hay crops (exclusive of soybean hay)	21, 789	15, 907
Alfalfa and alfalfa mixtures	9, 251	5, 561
Clover, timothy, mixed hay	11, 544	9, 854
Small grains cut for hay	379	110
Other hay cut	179	125
Grass silage	436	257
Red clover seed	1, 346	2, 253
Timothy seed	78	364
Vegetables for sale	71	167
Sweet corn	51	141
Snap beans	20	26

Livestock

The raising of hogs is the most important livestock enterprise in Madison County, and the raising of cattle and chickens is also important. Table 10 gives the number of livestock, including poultry, on farms in the county in 1954 and 1959.

TABLE 10.—*Number of livestock on farms in 1954 and1959*

Livestock	1954	1959
Cattle and calves	30, 062	24, 113
Milk cows	6, 780	3, 905
Heifers and heifer calves	9, 410	7, 422
Horses and mules	404	721
Hogs and pigs	88, 565	103, 847
Sheep and lambs	10, 298	11, 200
Chickens, 4 months old and over	182, 044	165, 077

Glossary

Alkalinity. See Reaction.

Alluvium. Soil material, such as sand, silt, or clay, that has been deposited on land by streams.

Association, soil. A group of soils geographically associated in a characteristic repeating pattern.

Bottom land. Low-lying land that is adjacent to a river or smaller stream and is generally rich in alluvium.

Calcareous soil. A soil containing enough calcium carbonate (often with magnesium carbonate) to effervesce (fizz) visibly when treated with cold, dilute hydrochloric acid.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay loam. Soil material that contains 27 to 40 percent clay and 20 to 45 percent sand.

Colluvium. Soil material, rock fragments, or both, moved by creep, slide, or local wash and deposited at the base of steep slopes.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistance are—

Loose.—Noncoherent; soil does not hold together in a mass.

Friable.—When moist, soil crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, soil crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, soil readily deformed by moderate pressure but can be pressed into a lump; will form a wire when rolled between thumb and forefinger.

Sticky.—When wet, soil adheres to other material, and tends to stretch somewhat and pull apart, rather than to pull free from other material.

Hard.—When dry, soil is moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, soil breaks into powder or individual grains under very slight pressure.

Cemented.—Hard and brittle; soil is little affected by moistening.

Contour farming. Plowing, cultivating, planting, and harvesting in rows that are parallel to terrace grade.

Cover crop. A close-growing crop that is grown primarily to improve the soil and to protect it between periods of regular crop production; or a crop grown between trees and vines in orchards and vineyards.

Crop residues. Parts of plants—leaves, stubble, roots, and straw—that are left in the field after harvest.

Deep soil. Generally, a soil that is more than 42 inches deep to rock or other contrasting material.

Diversion. A ridge of earth, generally a terrace, that is built to divert runoff from its natural course and, thus, to protect areas downslope from such runoff.

Drift (or glacial drift). Rock and earth material transported by ice sheets. Unsorted drift, called glacial till, consists of sand, clay, silt, and boulders that were left in place when the ice melted.

Effluent. Liquid sewage that flows out of a septic tank into a disposal field.

First bottom (or flood plain). The normal flood plain of a stream; flooding may be frequent or occasional.

Gleization. The reduction, translocation, and segregation of soil compounds, notably of iron, generally in the subsoil or substratum, as a result of poor aeration and drainage; indicated in the soil by mottles dominantly of gray. The soil-forming process leading to the development of a gley soil.

Green-manure crop. Any crop grown and plowed under for the purpose of improving the soil, especially by the addition of organic matter.

Horizon, soil. A layer of soil, approximately parallel to the surface, that has distinct characteristics produced by soil-forming processes and that differs in one or more ways from adjacent horizons in the same profile. These are the major soil horizons.

O horizon.—Organic horizon of mineral soils.

A horizon.—The mineral horizon at the surface. It contains an accumulation of organic matter, has been leached of soluble minerals and clay, or shows the effects of both.

B horizon.—The horizon in which clay minerals or other materials have accumulated, that has developed a characteristic blocky or prismatic structure, or that shows the characteristics of both processes.

C horizon.—The unconsolidated material immediately under the true soil. In chemical, physical, and mineral composition, it is presumed to be similar to the material from which at least part of the overlying solum has developed, unless the C designation is preceded by a Roman numeral.

R horizon.—Rock underlying the C horizon, or the B horizon if no C horizon is present.

Roman numerals are prefixed to the master horizon or layer designations (O, A, B, C, R) to indicate lithologic discontinuities either within or below the solum. The first, or

uppermost, material is not numbered, for the Roman numeral I is understood; the second, or contrasting, material is numbered II, and others are numbered III, IV, and so on, consecutively downward. Thus, for example, a sequence from the surface downward might be A2, B1, IIB2, IIB3, IIC1, IIC2.

Following are the symbols used in this report with the letters designating the master horizons, and the meaning of these symbols:

b—buried soil.
g—strong gleying.
p—plow layer.
t—illuvial clay.

Illuviation. The accumulation of material in a soil horizon through the deposition of suspended material and organic matter removed from horizons above. Since part of the fine clay in the B horizon (or subsoil) of many soils has moved into the B horizon from the A horizon above, the B horizon is called an illuvial horizon.

Immature soil. A soil lacking clearly defined horizons because the soil-forming forces have acted on the parent material for only a relatively short time after it was deposited or exposed.

Intercrop. A grass-legume or other crop that is seeded in small grain and plowed under the following spring before the succeeding crops are planted.

Lacustrine deposits. Material deposited in lake water and exposed by the lowering of the water level or by the raising of the land.

Loam. Soil material that contains 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand.

Loess. A fine-grained windblown deposit consisting dominantly of silt-sized particles.

Mapping unit. Any soil, miscellaneous land type, soil complex, or undifferentiated soil group shown on the detailed soil map and identified by a letter symbol.

Mature soil. Any soil that is in near equilibrium with its environment and has well-developed soil horizons produced by the natural processes of soil formation.

Mineral soil. Soil consisting mainly in inorganic (mineral) material and containing only a small amount of organic material. Its bulk density is greater than that of organic soil.

Moraine. An accumulation of earth, stones, and other debris deposited by a glacier.

Mottled. Irregularly marked with spots of different colors that vary in number and size. Mottling in soils usually indicates poor aeration and lack of drainage. Descriptive terms are as follows: *Abundance*—few, common, and many; *size*—fine, medium, and coarse; and *contrast*—faint, distinct and prominent. The size measurements are these: *Fine*, less than 5 millimeters (about 0.2 inch) in diameter along the greatest dimension; *medium*, ranging from 5 to 15 millimeters (about 0.2 to 0.6 inch) in diameter along the greatest dimension; and *coarse*, more than 15 millimeters (about 0.6 inch) in diameter along the greatest dimension.

Muck. An organic soil consisting of fairly well decomposed organic material that is relatively high in mineral content, finely divided, and dark in color.

Organic soil. A general term applied to a soil or to a soil horizon that consists primarily of organic matter, such as the material in peat soils, muck soils, and peaty soil layers. In chemistry, "organic" refers to the compounds of carbon.

Outwash. Crossbedded gravel, sand, and silt deposited by melt water as it flowed from the ice.

Permeability, soil. The quality of a soil horizon that enables water or air to move through it. Terms used to describe permeability are as follows: *Very slow, slow, moderately slow, moderate, moderately rapid, rapid,* and *very rapid.*

Peat. Unconsolidated soil material, largely undecomposed organic matter, that has accumulated where there has been excess moisture.

pH. See Reaction, soil.

Phase, soil. A subdivision of a soil type, series, or other unit in the soil classification system made because of differences in the soil that affect its management but do not affect its classification in the natural landscape. A soil type, for example, may be divided into phases because of differences in slope, stoniness, thickness, or some other characteristic that affects management.

Plow layer. The soil ordinarily moved in tillage; equivalent to surface soil.

Profile, soil. A vertical section of the soil through all its horizons and extending into the parent material. See Horizon, soil.

Reaction, soil. The degree of acidity or alkalinity of a soil expressed in pH values. A soil that tests to pH 7.0 is precisely neutral in reaction because it is neither acid nor alkaline. In words the degree of acidity or alkalinity is expressed thus (*13*):

	pH		*pH*
Extremely acid	Below 4.5	Mildly alkaline	7.4 to 7.8
Very strongly acid	4.5 to 5.0	Moderately alkaline	7.9 to 8.4
Strongly acid	5.1 to 5.5	Strongly alkaline	8.5 to 9.0
Medium acid	5.6 to 6.0	Very strongly alkaline	9.1 and higher
Slightly acid	6.1 to 6.5		
Neutral	6.6 to 7.3		

Relative humidity. The ratio of the mass of moisture actually present in any volume of air of a given temperature to the maximum amount possible at that temperature and pressure, usually expressed as a percentage.

Relief. The elevations or inequalities of a land surface, considered collectively.

Runoff (or surface runoff). The rate at which water is removed by flow over the surface of the soil. The rapidity of runoff and the amount of water removed are closely related to slope and are also affected by factors such as texture, structure, and porosity of the surface soil; the vegetative covering; and the prevailing climate.

Sand. Individual rock or mineral fragments in soils having diameters ranging from 0.05 millimeter to 2.0 millimeters. Most sand grains consist of quartz, but they may be of any mineral composition. The textural class name of any soil that contains 85 percent or more sand and not more than 10 percent clay.

Second bottom. The first terrace above the normal flood plain of a stream.

Series, soil. A group of soils developed from a particular type of parent material and having genetic horizons that, except for texture of the surface soil, are similar in differentiating characteristics and in arrangement in the profile.

Silt. Soil material that contains 80 percent or more silt and less than 12 percent clay.

Silt loam. Soil material that contains 50 percent or more silt and 12 to 27 percent clay; or soil material that contains 50 to 80 percent silt and less than 12 percent clay.

Silty clay. Soil material that contains 40 percent or more clay and 40 percent or more of silt.

Silty clay loam. Soil material that contains 27 to 40 percent clay and less than 20 percent sand.

Slope classes. As used in this report, slopes, in percent, are designated as follows:

Nearly level	0 to 2
Gently sloping	2 to 6
Sloping	6 to 12
Moderately steep	12 to 18
Steep	18 to 25
Very steep	25 to 50

Soil. A natural, three-dimensional body on the earth's surface that supports plants and that has properties resulting from the integrated effect of climate and living matter acting upon parent material, as conditioned by relief over periods of time.

Solum, soil. The upper part of a soil profile, above the parent material, in which the processes of soil formation are active. The solum in mature soils includes the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and other plant and animal life characteristic of the soil are largely confined to the solum.

Stratified. Composed of, or arranged in, strata, or layers, such as stratified alluvium. The term is confined to geological material. Layers in soils that result from the processes of soil formation are called horizons; those inherited from the parent material are called strata.

Stripcropping. Growing crops in a systematic arrangement of strips, or bands, that serve as vegetative barriers to wind and water erosion.

Structure, soil. The arrangement of the primary soil particles into compound particles or clusters that are separated from adjoining aggregates and have properties unlike those of an

equal mass of unaggregated primary soil particles. The principal forms of soil structure are *platy* (laminated), *prismatic* (verticle axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are (1) *single grain* (each grain by itself, as in dune sand) or (2) *massive* (the particles adhering together without any regular cleavage, as in many claypans and hardpans).

Subsoil. In many soils, the B horizon; roughly, the part of the profile below plow depth.

Substratum. Any layer beneath the solum, or true soil; the C or R horizon.

Subsurface layer. The part of the A horizon beneath the surface soil.

Surface layer. A term used in nontechnical soil descriptions for one or more upper layers of soil. It may include all or only part of the A horizon, and it has no depth limit.

Terrace, agricultural. An embankment or ridge constructed across sloping soils, on or approximately on contour lines, at specified intervals. The terrace intercepts and holds runoff so that it soaks into the soil, or it conducts the excess water to an outlet.

Terrace, geological. An old alluvial plain, often called a second bottom, that now lies above the present first bottom as a result of entrenchment of the stream; seldom subject to flooding.

Texture, soil. The relative proportion of the various size groups of individual soil grains in a mass of soil. A coarse-textured soil is high in content of sand; a fine-textured soil has a large proportion of clay. The textural names of the soils in this county are listed in this Glossary in alphabetic order and defined.

Till (or glacial till). An unstratified deposit of earth, sand, gravel, and boulders transported by glaciers.

Till plain. A level or undulating land surface that was formed when glaciers deposited their till.

Tilth, soil. The condition of the soil in relation to the growth of plants, especially soil structure. Good tilth refers to the friable state and is associated with high noncapillary porosity and stable, granular structure. A soil in poor tilth is nonfriable, hard, nonaggregated, and difficult to till.

Topsoil. A presumed fertile soil or soil material, ordinarily rich in organic matter, used to topdress roadbanks, lawns, and gardens.

Type, soil. A subdivision of the soil series that is made on the basis of differences in the texture of the surface layer.

Upland (geology). Land consisting of material unworked by water in recent geologic time and lying, in general, at a higher elevation than the alluvial plain or stream terrace. Land above the lowlands along rivers.

Water table. The highest part of the soil or underlying rock material that is wholly saturated with water. In some places an upper, or perched, water table may be separated from a lower one by a dry zone.

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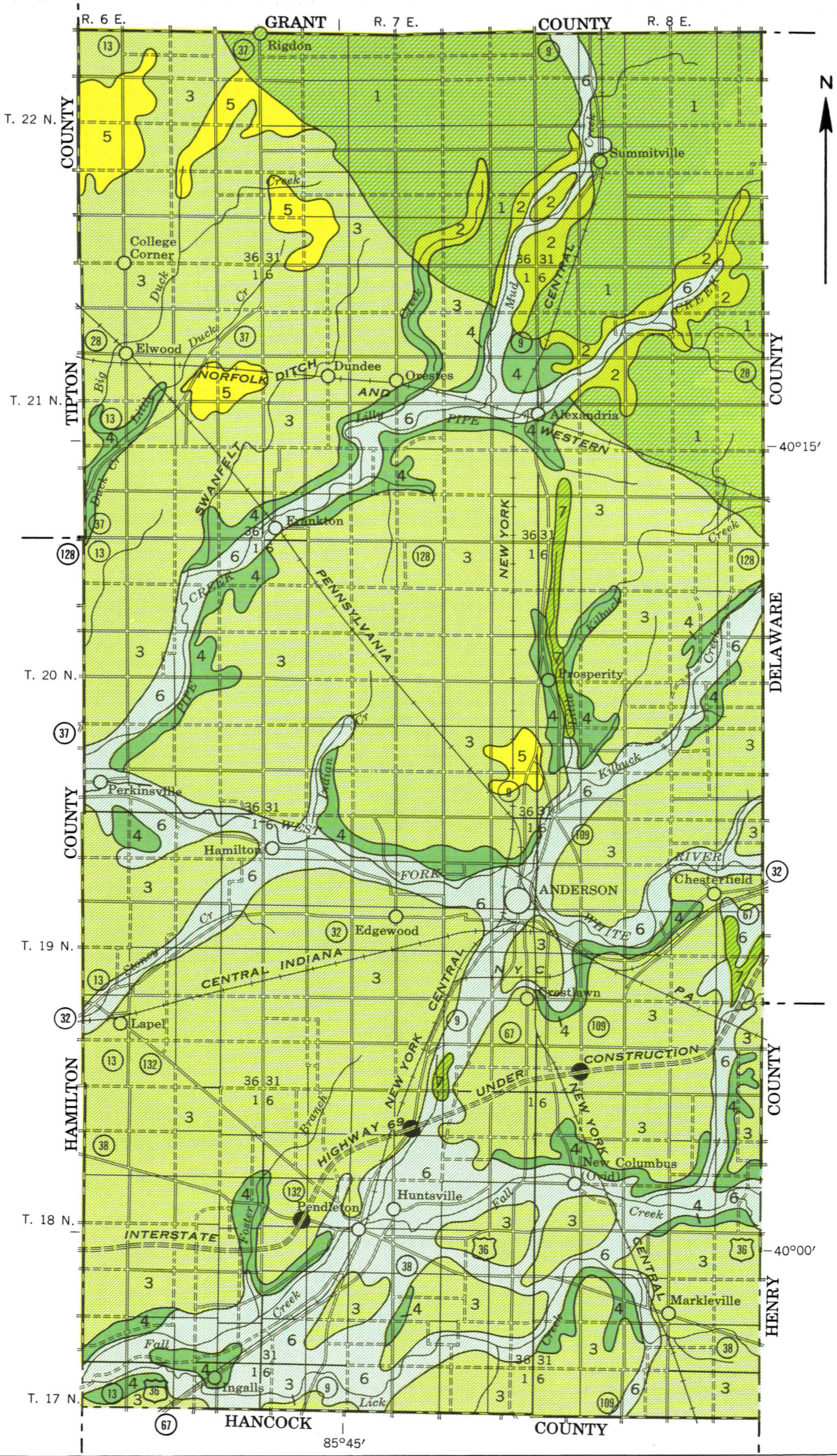


U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
PURDUE UNIVERSITY
AGRICULTURAL EXPERIMENT STATION

GENERAL SOIL MAP
MADISON COUNTY, INDIANA

Scale 1: 190,080

1 0 1 2 3 4 Miles

SOIL ASSOCIATIONS

1 Blount-Pewamo association: Nearly level and gently sloping soils formed in moderately fine textured till on uplands

2 Morley association: Gently sloping and strongly sloping soils formed in fine-textured till on uplands

3 Brookston-Crosby association: Nearly level and gently sloping soils formed in medium-textured till on uplands

4 Miami-Celina and Fox, till substratum, association: Gently sloping to steep soils formed in medium-textured glacial drift on uplands

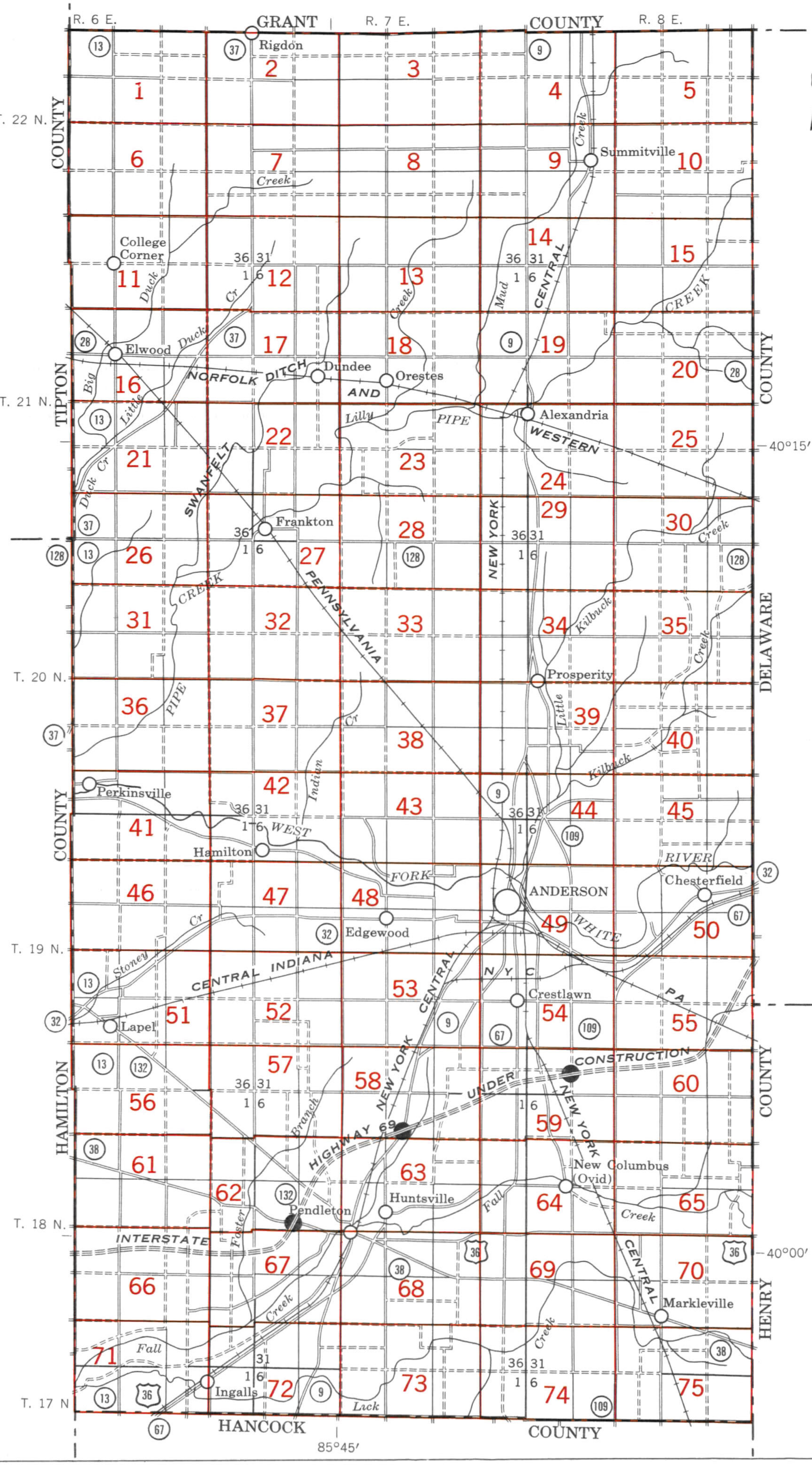
5 Mahalasville-Sleeth association: Nearly level soils on outwash plains

6 Fox-Eel association: Nearly level to strongly sloping soils on terraces and flood plains

7 Carlisle-Edwards-Linwood association: Nearly level organic soils in depressions

November 1965

INDEX TO MAP SHEETS
MADISON COUNTY, INDIANA



SOIL LEGEND

The first capital letter is the initial one of the soil name. A second capital letter, A, B, C, D, E, or F, shows the slope. Symbols without a slope letter are for nearly level soils or land types. A final number, 2 or 3, in the symbol, shows that the soil is moderately or severely eroded.

SYMBOL	NAME
BoA	Blount silt loam, 0 to 2 percent slopes
BoB2	Blount silt loam, 2 to 6 percent slopes, moderately eroded
Br	Brookston silt loam
Bs	Brookston silty clay loam
CaA	Camden silt loam, 0 to 2 percent slopes
CaB2	Camden silt loam, 2 to 6 percent slopes, moderately eroded
Cm	Carlisle muck
CnA	Celina silt loam, 0 to 2 percent slopes
CnB2	Celina silt loam, 2 to 6 percent slopes, moderately eroded
Cp	Clay pits
CrA	Crosby silt loam, 0 to 2 percent slopes
CrB2	Crosby silt loam, 2 to 6 percent slopes, moderately eroded
Ed	Edwards muck
Es	Eel silt loam
FaA	Fox fine sandy loam, 0 to 2 percent slopes
FaB	Fox fine sandy loam, 2 to 6 percent slopes
FoA	Fox silt loam, 0 to 2 percent slopes
FoB2	Fox silt loam, 2 to 6 percent slopes, moderately eroded
FoC2	Fox silt loam, 6 to 12 percent slopes, moderately eroded
FoD2	Fox silt loam, 12 to 18 percent slopes, moderately eroded
FrA	Fox silt loam, limestone substratum, 0 to 2 percent slopes
FsA	Fox silt loam, till substratum, 0 to 2 percent slopes
FsB	Fox silt loam, till substratum, 2 to 6 percent slopes
FsB2	Fox silt loam, till substratum, 2 to 6 percent slopes, moderately eroded
FsC	Fox silt loam, till substratum, 6 to 12 percent slopes
FsC2	Fox silt loam, till substratum, 6 to 12 percent slopes, moderately eroded
FtC3	Fox soils, 6 to 12 percent slopes, severely eroded
FxB3	Fox soils, till substratum, 2 to 6 percent slopes, severely eroded
Gn	Genesee silt loam
Gr	Gravel pits
HeF2	Hennepin soils, 18 to 35 percent slopes, eroded
Hm	Homer silt loam
Hn	Homer silt loam, limestone substratum
Kc	Kokomo silty clay loam
Kg	Kokomo silty clay loam, gravelly substratum
Km	Kokomo silty clay loam, stratified substratum
Ks	Kokomo mucky silt loam, stratified substratum
Kt	Kokomo mucky silty clay loam, gravelly substratum
Lm	Linwood muck
Ma	Made land
Mh	Mahalasville silt loam
Ml	Mahalasville silty clay loam
Mm	Mahalasville silty clay loam, limestone substratum
MnA	Miami silt loam, 0 to 2 percent slopes
MnB2	Miami silt loam, 2 to 6 percent slopes, moderately eroded
MnC2	Miami silt loam, 6 to 12 percent slopes, moderately eroded
MnD2	Miami silt loam, 12 to 18 percent slopes, moderately eroded
MnE2	Miami silt loam, 18 to 25 percent slopes, moderately eroded
MpB3	Miami soils, 2 to 6 percent slopes, severely eroded
MpC3	Miami soils, 6 to 12 percent slopes, severely eroded
MpD3	Miami soils, 12 to 18 percent slopes, severely eroded
MpE3	Miami soils, 18 to 25 percent slopes, severely eroded
MrB2	Morley silt loam, 2 to 6 percent slopes, moderately eroded
MrC2	Morley silt loam, 6 to 12 percent slopes, moderately eroded
MrD	Morley silt loam, 12 to 18 percent slopes
MsB3	Morley soils, 2 to 6 percent slopes, severely eroded
MsC3	Morley soils, 6 to 12 percent slopes, severely eroded
MsD3	Morley soils, 12 to 18 percent slopes, severely eroded
OcA	Ockley silt loam, 0 to 2 percent slopes
OcB	Ockley silt loam, 2 to 6 percent slopes
Pc	Pewamo silty clay loam
RdE2	Rodman soils, 12 to 50 percent slopes, eroded
Ro	Ross loam
Rs	Ross silt loam
Sh	Shoals silt loam
Sl	Sleeth silt loam
Sm	Sleeth silt loam, loamy substratum
So	Sloan silt loam
Wa	Wallkill complex
Wc	Washtenaw complex
Wd	Westland silty clay loam
Ws	Westland silty clay loam, moderately deep

CONVENTIONAL SIGNS

WORKS AND STRUCTURES

Highways and roads
- Dual
- Good motor
- Poor motor
- Trail

Highway markers
- National Interstate
- U. S.
- State

Railroads
- Single track
- Multiple track
- Abandoned

Bridges and crossings
- Road
- Trail, foot
- Railroad
- Ferries
- Ford
- Grade
- R. R. over
- R. R. under
- Tunnel

Buildings
- School
- Church
- Station

Mines and Quarries
- Mine dump
- Pits, gravel or other

Power lines

Pipe lines

Cemeteries

Dams

Levees

Tanks

Oil wells

BOUNDARIES

- National or state
- County
- Township, U. S.
- Section line, corner
- Reservation
- Land grant
- Township, civil

DRAINAGE

Streams
- Perennial
- Intermittent, unclass.

Canals and ditches — CANAL, DITCH

Lakes and ponds
- Perennial
- Intermittent

Wells — flowing

Springs

Marsh

Wet spot

Alluvial fan

Drainage ends

RELIEF

Escarpments
- Bedrock
- Other

Prominent peaks

Depressions (Large, Small)
- Crossable with tillage implements
- Not crossable with tillage implements
- Contains water most of the time

SOIL SURVEY DATA

- Soil boundary and symbol — Dx
- Gravel
- Stones
- Rock outcrops
- Chert fragments
- Clay spot
- Sand spot
- Gumbo or scabby spot
- Made land
- Severely eroded spot
- Blowout, wind erosion
- Gullies

Soil map constructed 1965 by Cartographic Division, Soil Conservation Service, USDA, from 1961 aerial photographs. Controlled mosaic based on Indiana plane coordinate system, east zone, transverse Mercator projection, 1927 North American datum.

GUIDE TO MAPPING UNITS

[See table 1, p. 7, for approximate acreage and proportionate extent of the soils; see table 2, p. 34, for estimated average yields of principal crops; see subsection beginning on p. 35 for woodland suitability groups; and see subsection beginning on p. 40 for information significant to engineering]

Map symbol	Soil	Described on page	Capability unit		Woodland suitability group
			Symbol	Page	Number
BoA	Blount silt loam, 0 to 2 percent slopes	8	IIw-2	26	5
BoB2	Blount silt loam, 2 to 6 percent slopes, moderately eroded	8	IIw-2	26	5
Br	Brookston silt loam	8	IIw-1	25	11
Bs	Brookston silty clay loam	8	IIw-1	25	11
CaA	Camden silt loam, 0 to 2 percent slopes	8	I-1	23	1
CaB2	Camden silt loam, 2 to 6 percent slopes, moderately eroded	8	IIe-1	23	1
Cm	Carlisle muck	9	IIIw-8	31	23
CnA	Celina silt loam, 0 to 2 percent slopes	9	I-1	23	1
CnB2	Celina silt loam, 2 to 6 percent slopes, moderately eroded	9	IIe-1	23	1
Cp	Clay pits	9	-----	--	23
CrA	Crosby silt loam, 0 to 2 percent slopes	10	IIw-2	26	5
CrB2	Crosby silt loam, 2 to 6 percent slopes, moderately eroded	10	IIw-2	26	5
Ed	Edwards muck	10	IVw-3	32	23
Es	Eel silt loam	10	IIw-7	28	8
FaA	Fox fine sandy loam, 0 to 2 percent slopes	11	IIs-1	28	2
FaB	Fox fine sandy loam, 2 to 6 percent slopes	12	IIIe-9	30	2
FoA	Fox silt loam, 0 to 2 percent slopes	11	IIs-1	28	1
FoB2	Fox silt loam, 2 to 6 percent slopes, moderately eroded	11	IIe-9	25	1
FoC2	Fox silt loam, 6 to 12 percent slopes, moderately eroded	11	IIIe-9	30	1
FoD2	Fox silt loam, 12 to 18 percent slopes, moderately eroded	11	IVe-9	32	1
FrA	Fox silt loam, limestone substratum, 0 to 2 percent slopes	12	IIs-4	28	1
FsA	Fox silt loam, till substratum, 0 to 2 percent slopes	12	I-1	23	1
FsB	Fox silt loam, till substratum, 2 to 6 percent slopes	12	IIe-1	23	1
FsB2	Fox silt loam, till substratum, 2 to 6 percent slopes, moderately eroded	12	IIe-1	23	1
FsC	Fox silt loam, till substratum, 6 to 12 percent slopes	12	IIIe-1	29	1
FsC2	Fox silt loam, till substratum, 6 to 12 percent slopes, moderately eroded	12	IIIe-1	29	1
FtC3	Fox soils, 6 to 12 percent slopes, severely eroded	11	IVe-9	32	1
FxB3	Fox soils, till substratum, 2 to 6 percent slopes, severely eroded	12	IIIe-1	29	1
Gn	Genesee silt loam	13	I-2	23	8
Gr	Gravel pits	13	-----	--	23
HeF2	Hennepin soils, 18 to 35 percent slopes, eroded	13	VIIe-2	33	2
Hm	Homer silt loam	13	IIw-6	27	5
Hn	Homer silt loam, limestone substratum	13	IIIw-7	30	5
Kc	Kokomo silty clay loam	14	IIw-1	25	11
Kg	Kokomo silty clay loam, gravelly substratum	14	IIw-1	25	11
Km	Kokomo silty clay loam, stratified substratum	14	IIw-1	25	11
Ks	Kokomo mucky silt loam, stratified substratum	14	IIw-1	25	11
Kt	Kokomo mucky silty clay loam, gravelly substratum	14	IIw-1	25	11
Lm	Linwood muck	14	IIw-10	28	23
Ma	Made land	14	-----	--	23
Mh	Mahalasville silt loam	15	IIw-1	25	11
Ml	Mahalasville silty clay loam	15	IIw-1	25	11
Mm	Mahalasville silty clay loam, limestone substratum	15	IIIw-5	30	11
MnA	Miami silt loam, 0 to 2 percent slopes	15	I-1	23	1
MnB2	Miami silt loam, 2 to 6 percent slopes, moderately eroded	15	IIe-1	23	1
MnC2	Miami silt loam, 6 to 12 percent slopes, moderately eroded	16	IIIe-1	29	1
MnD2	Miami silt loam, 12 to 18 percent slopes, moderately eroded	16	IVe-1	31	1
MnE2	Miami silt loam, 18 to 25 percent slopes, moderately eroded	16	VIe-1	32	2
MpB3	Miami soils, 2 to 6 percent slopes, severely eroded	16	IIIe-1	29	1
MpC3	Miami soils, 6 to 12 percent slopes, severely eroded	16	IVe-1	31	1
MpD3	Miami soils, 12 to 18 percent slopes, severely eroded	16	VIe-1	32	1
MpE3	Miami soils, 18 to 25 percent slopes, severely eroded	16	VIe-1	32	2
MrB2	Morley silt loam, 2 to 6 percent slopes, moderately eroded	17	IIe-6	25	1
MrC2	Morley silt loam, 6 to 12 percent slopes, moderately eroded	17	IIIe-6	29	1
MrD	Morley silt loam, 12 to 18 percent slopes	17	IVe-6	32	1
MsB3	Morley soils, 2 to 6 percent slopes, severely eroded	17	IIIe-6	29	1
MsC3	Morley soils, 6 to 12 percent slopes, severely eroded	17	IVe-6	32	1
MsD3	Morley soils, 12 to 18 percent slopes, severely eroded	17	VIe-1	32	1
OcA	Ockley silt loam, 0 to 2 percent slopes	18	I-1	23	1
OcB	Ockley silt loam, 2 to 6 percent slopes	18	IIe-1	23	1
Pc	Pewamo silty clay loam	18	IIw-1	25	11
RdE2	Rodman soils, 12 to 50 percent slopes, eroded	19	VIIs-1	33	19
Ro	Ross loam	19	I-2	23	23
Rs	Ross silt loam	19	I-2	23	23
Sh	Shoals silt loam	19	IIw-7	28	13
Sl	Sleeth silt loam	19	IIw-2	26	5
Sm	Sleeth silt loam, loamy substratum	20	IIw-2	26	5
So	Sloan silt loam	20	IIIw-9	31	11
Wa	Wallkill complex	20	IIw-7	28	23
Wc	Washtenaw complex	20	IIw-1	25	11
Wd	Westland silty clay loam	21	IIw-1	25	11
Ws	Westland silty clay loam, moderately deep	21	IIw-4	26	11

209-364 O - 67 (Face Blank p. 90) No. 1

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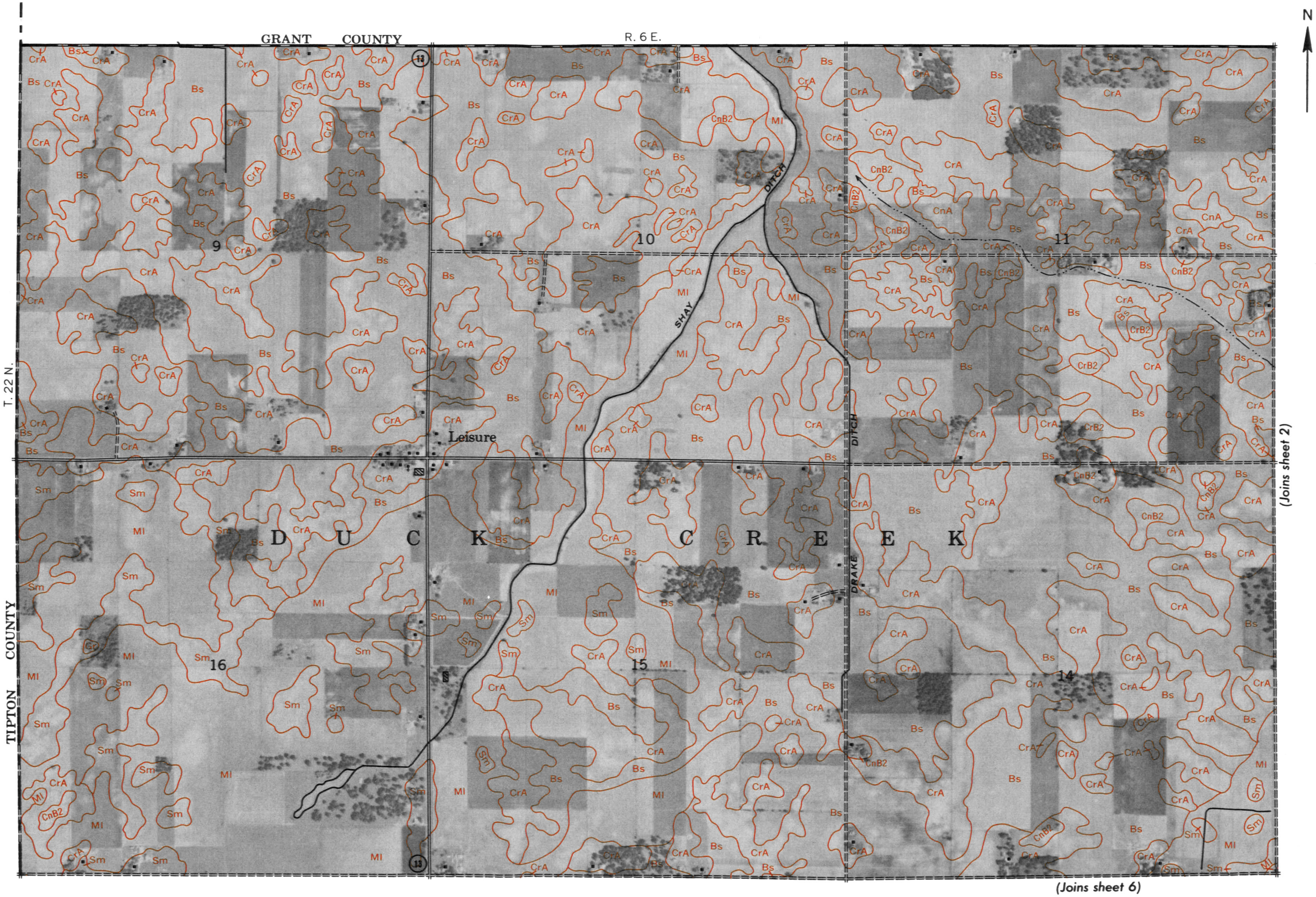

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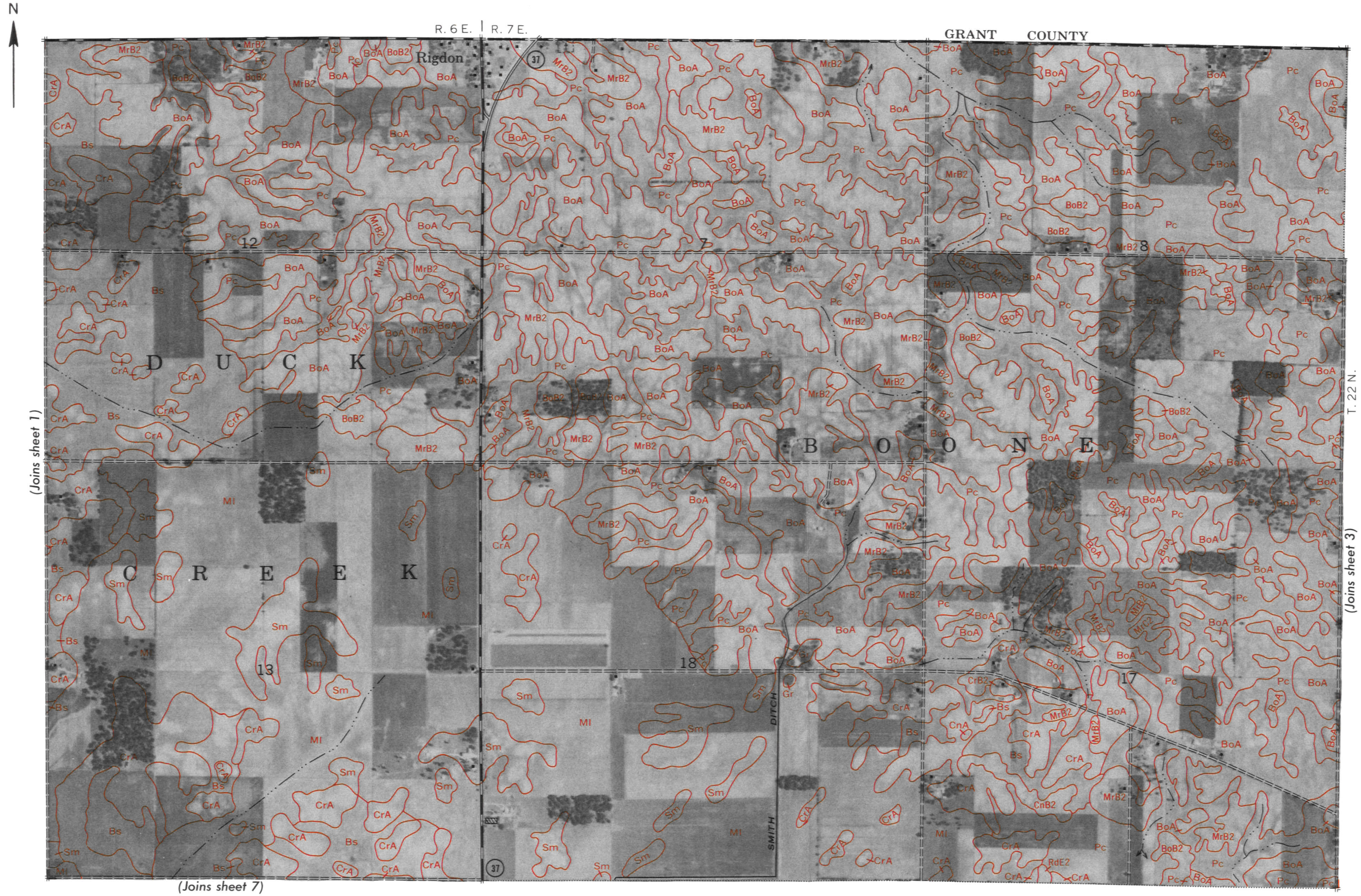

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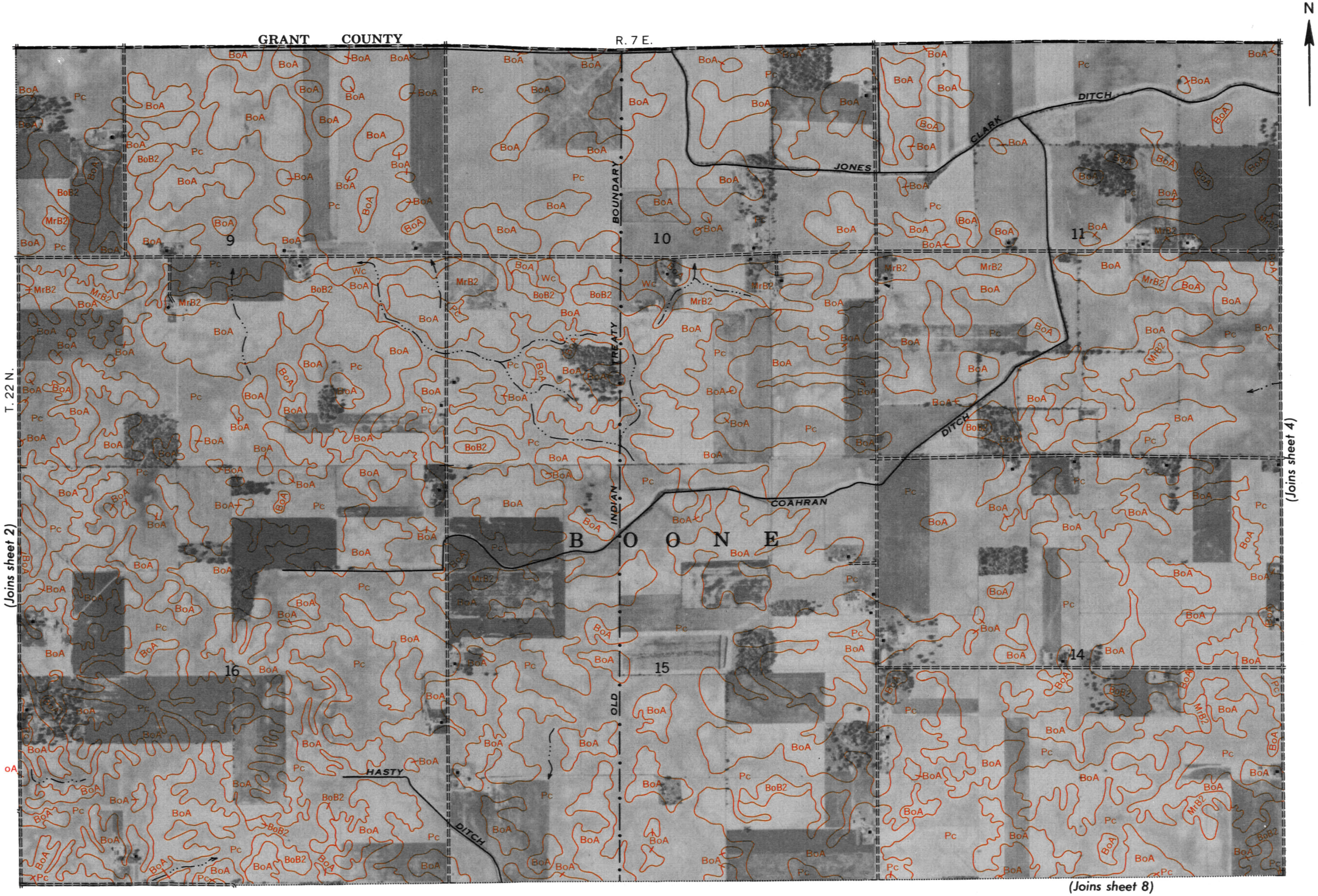

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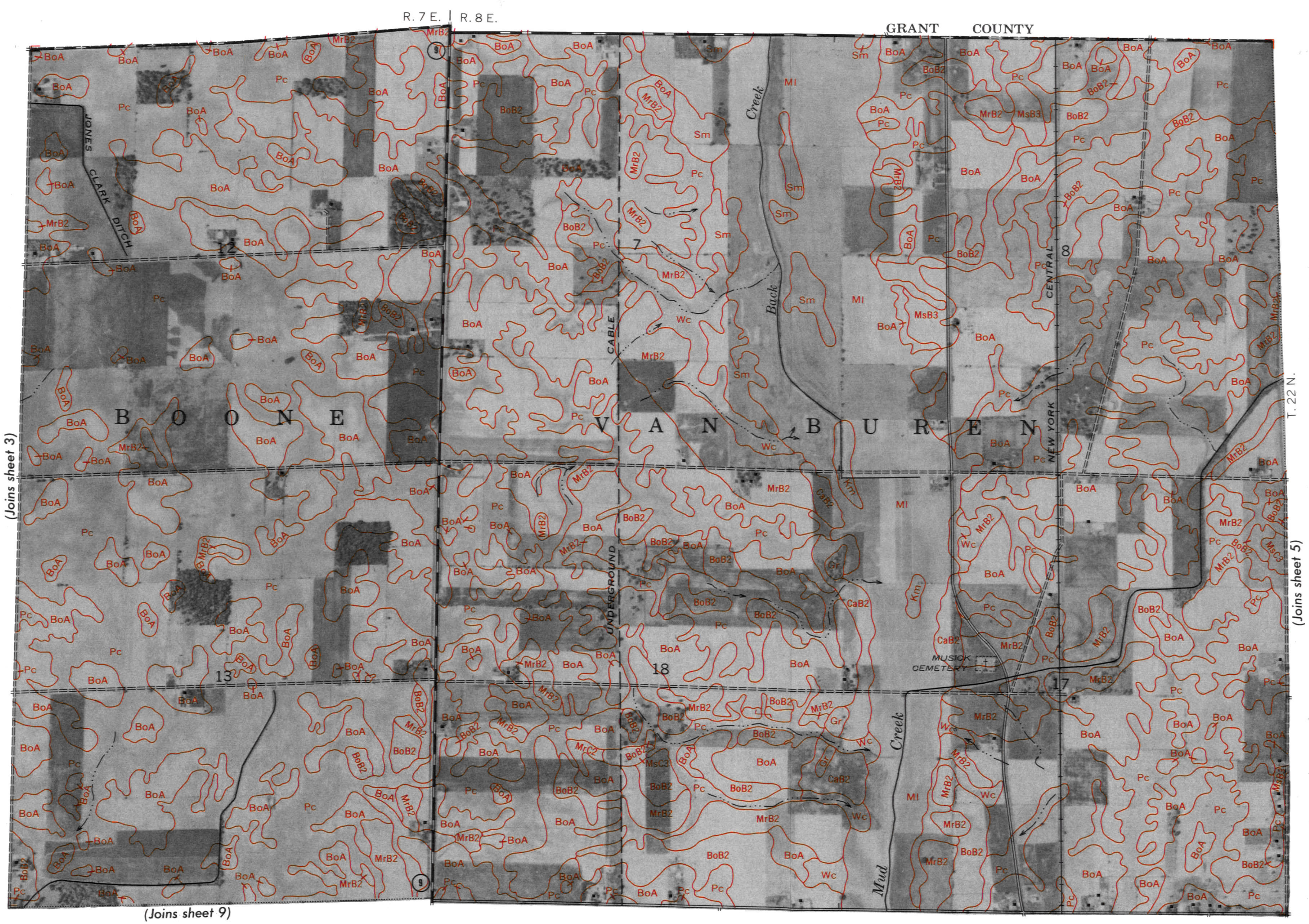

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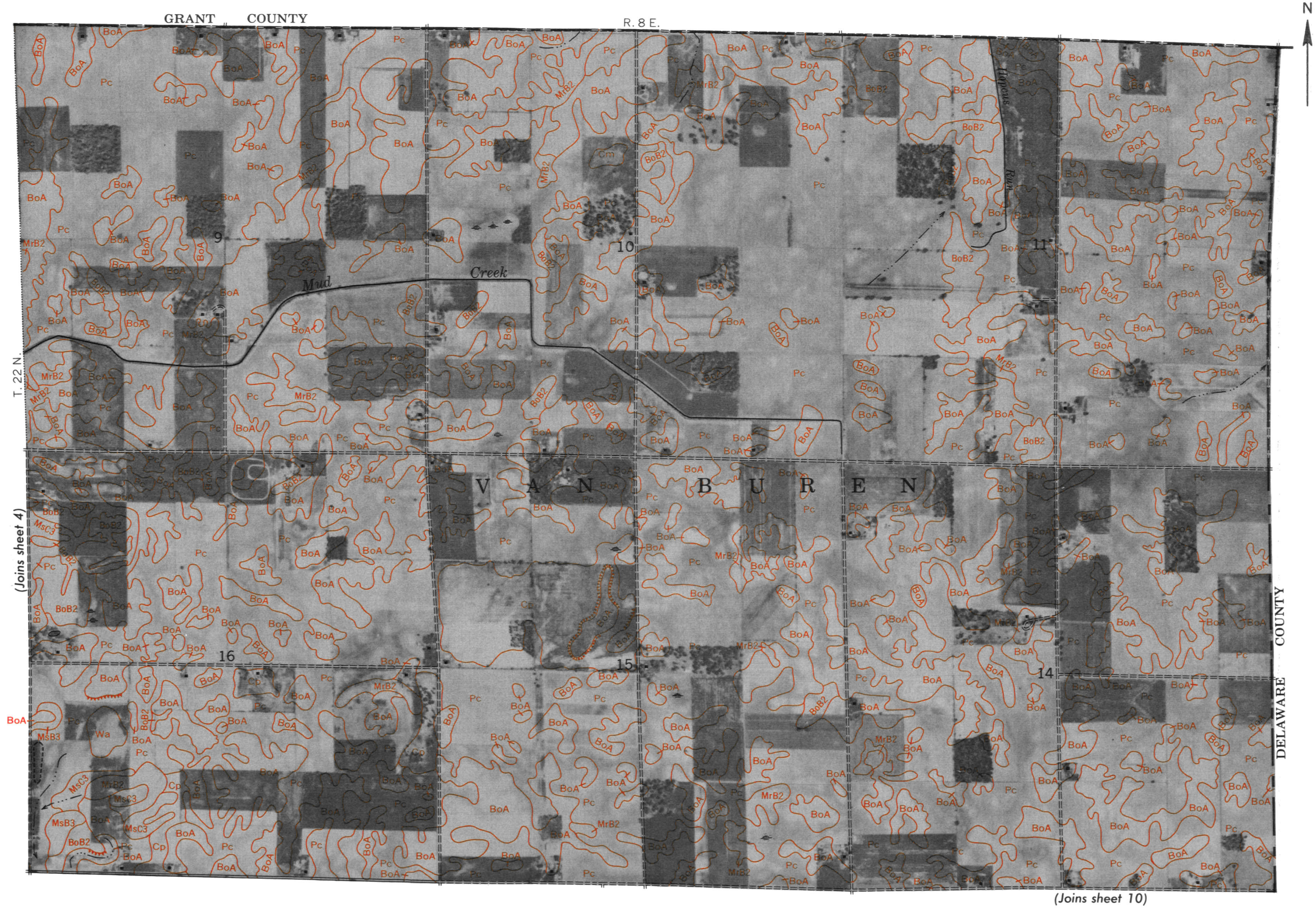

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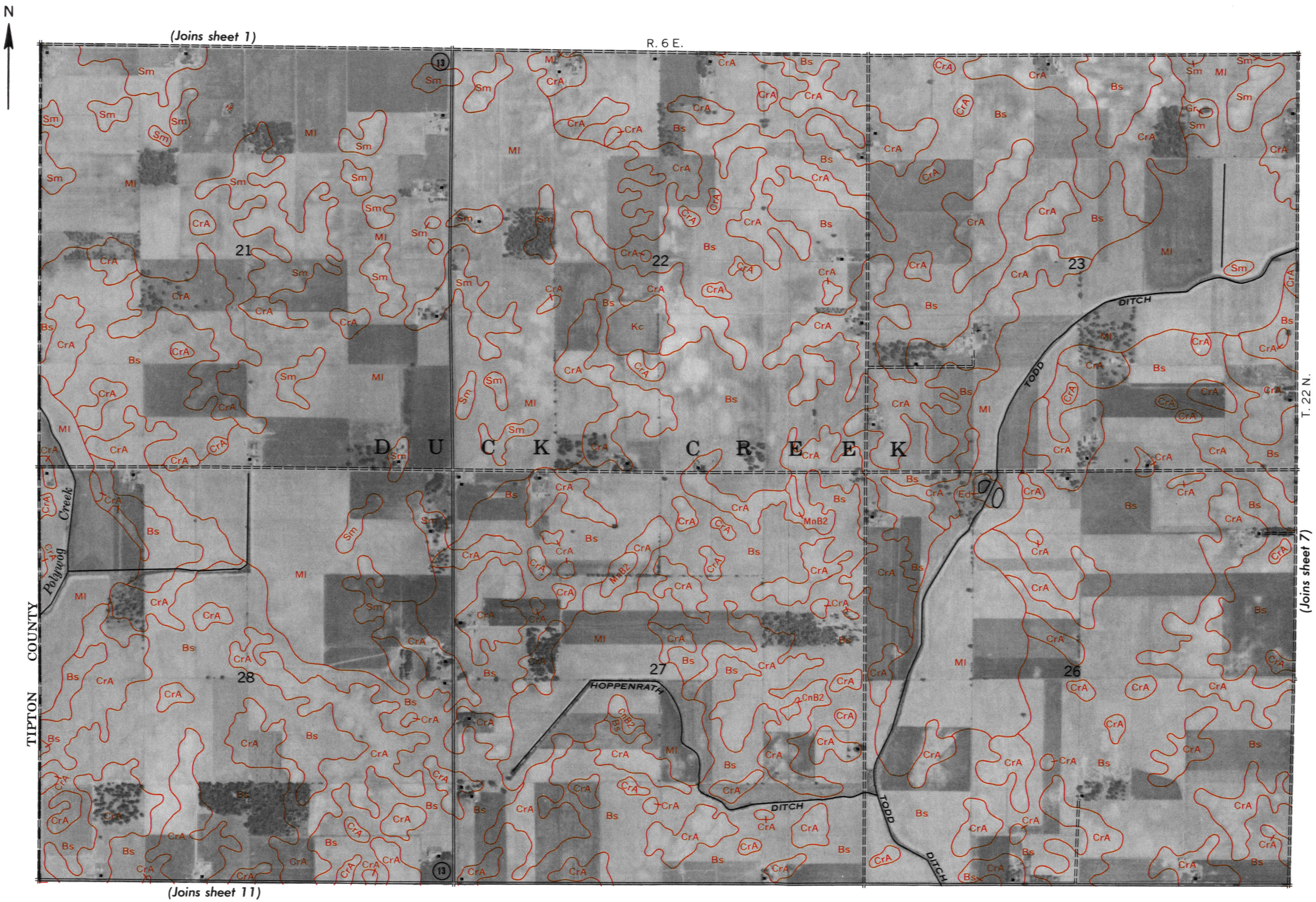

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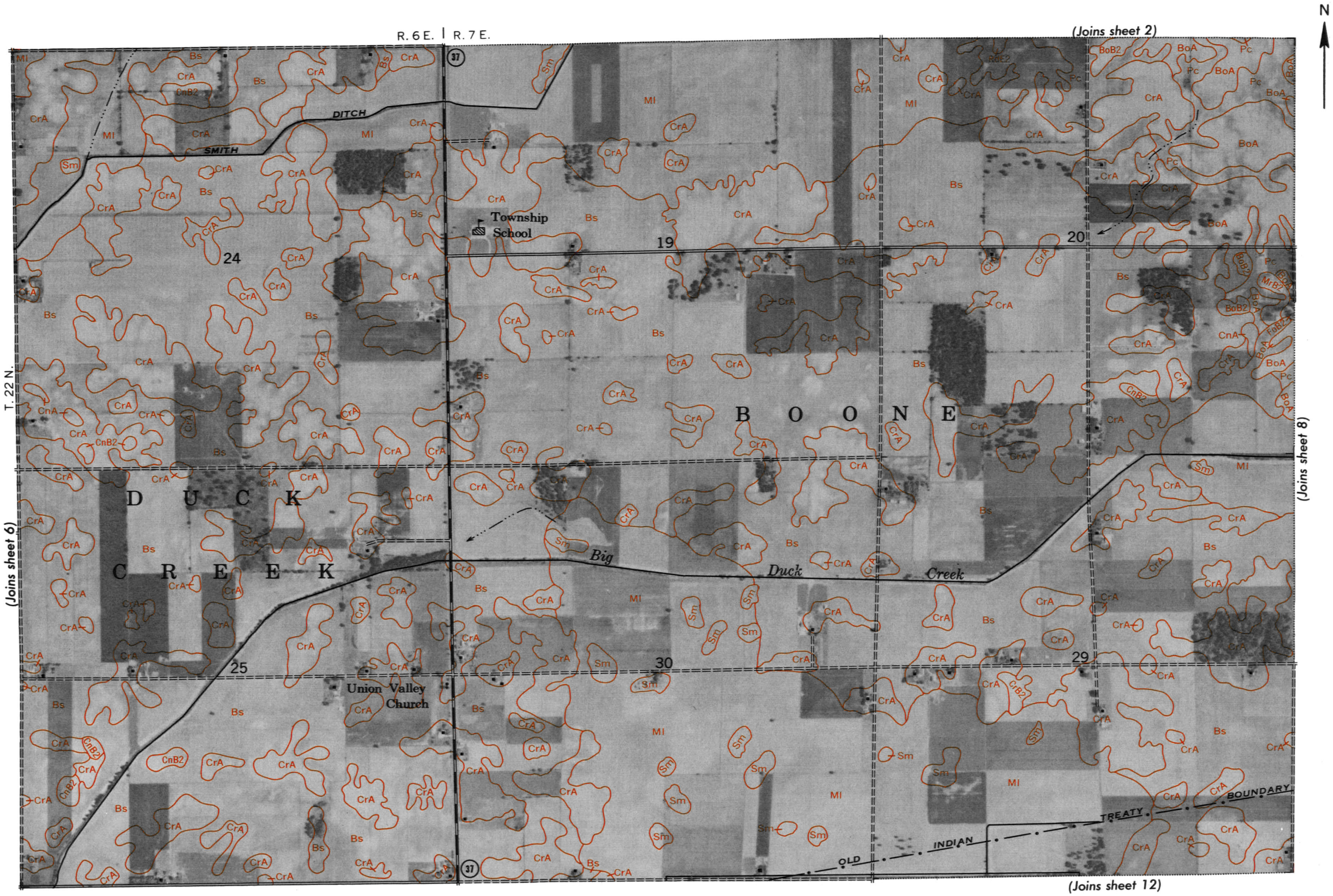

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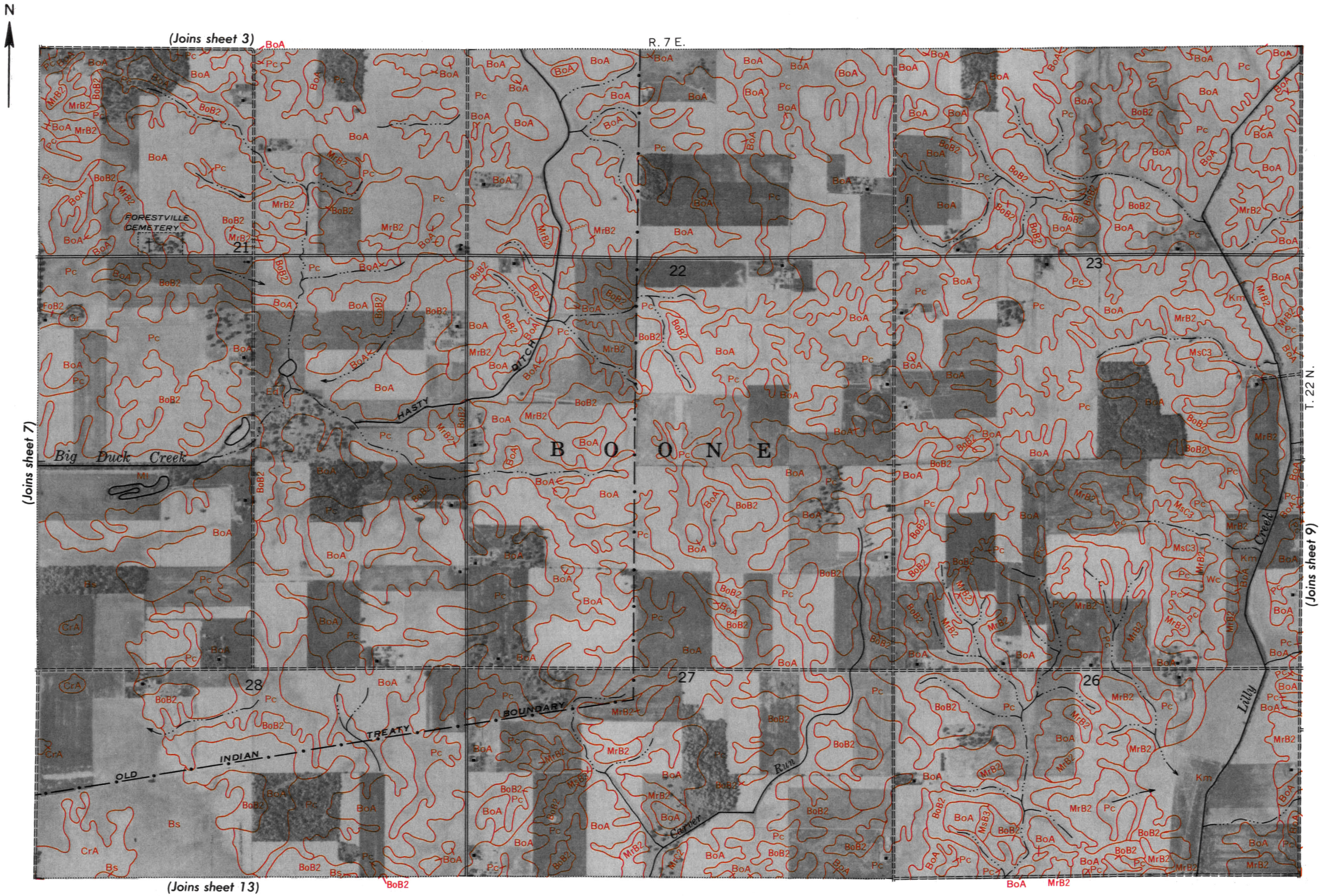

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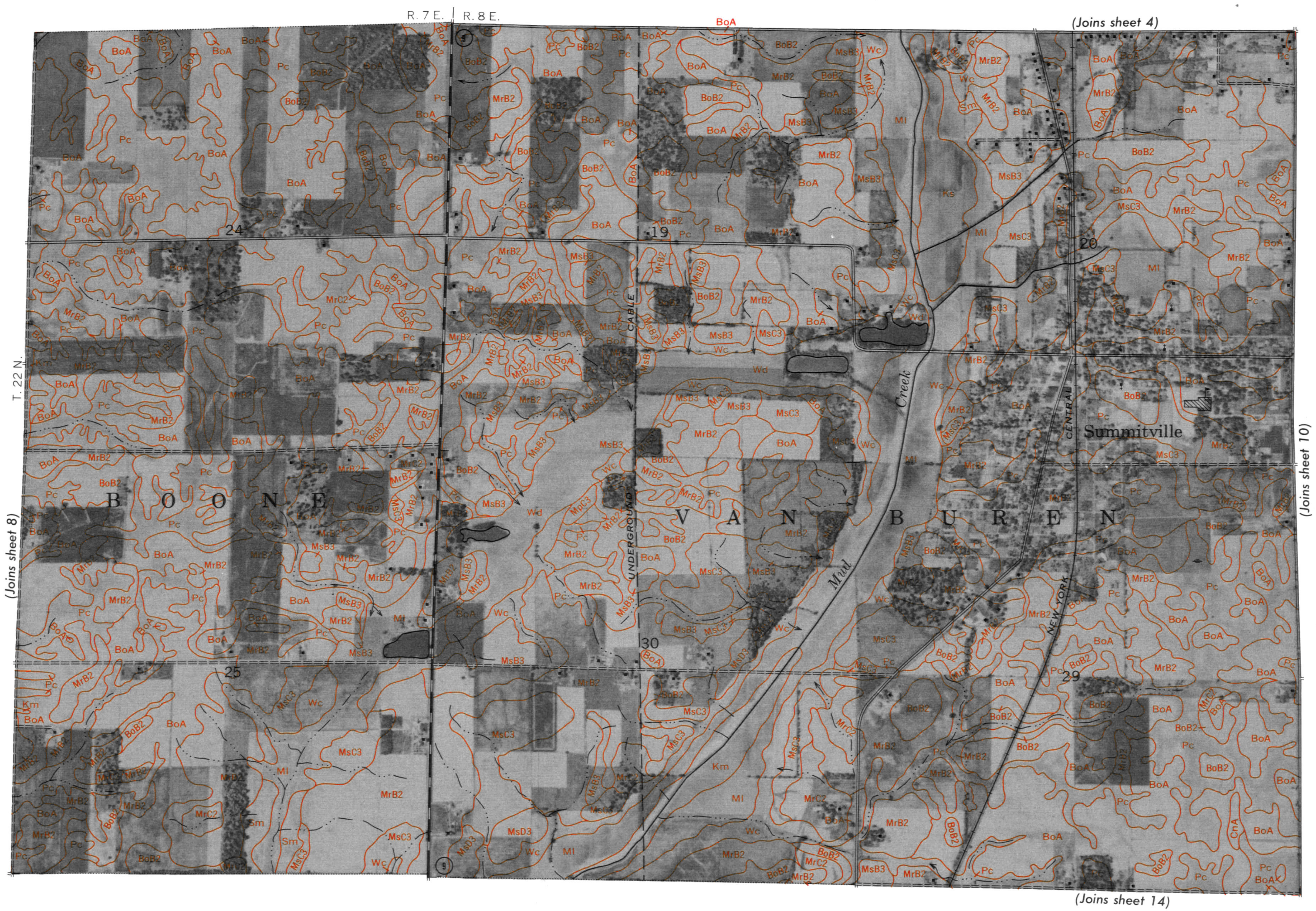

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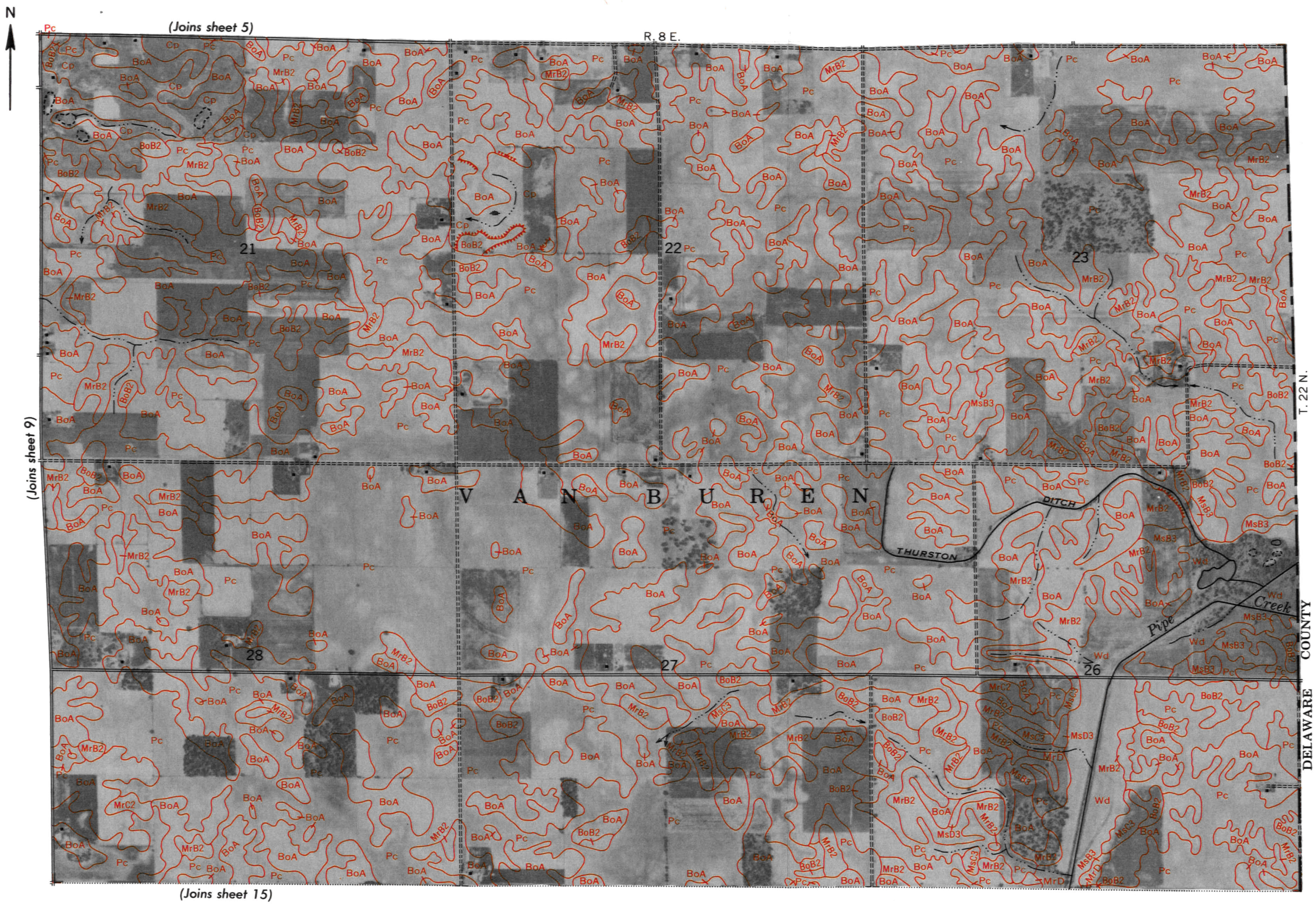

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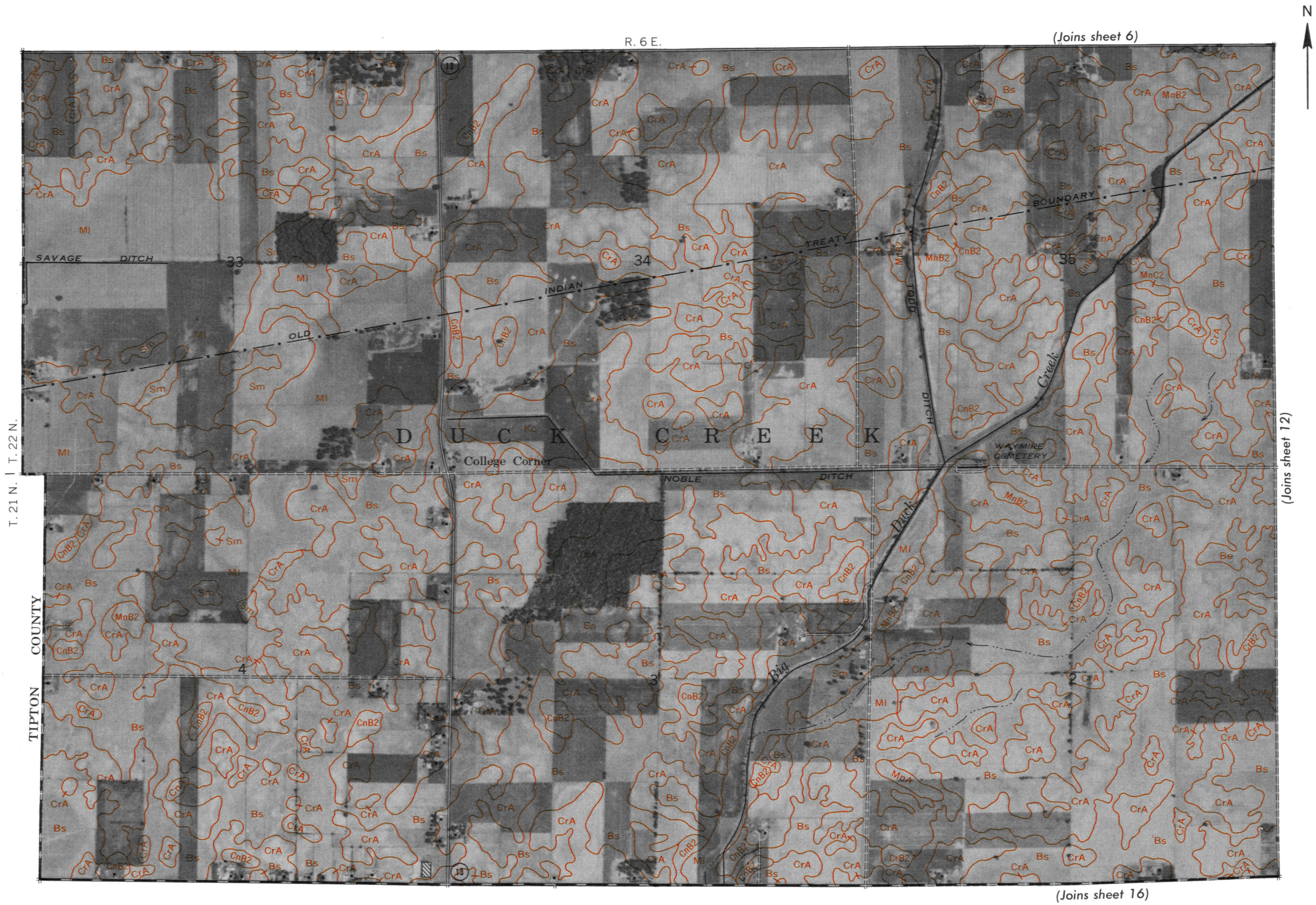

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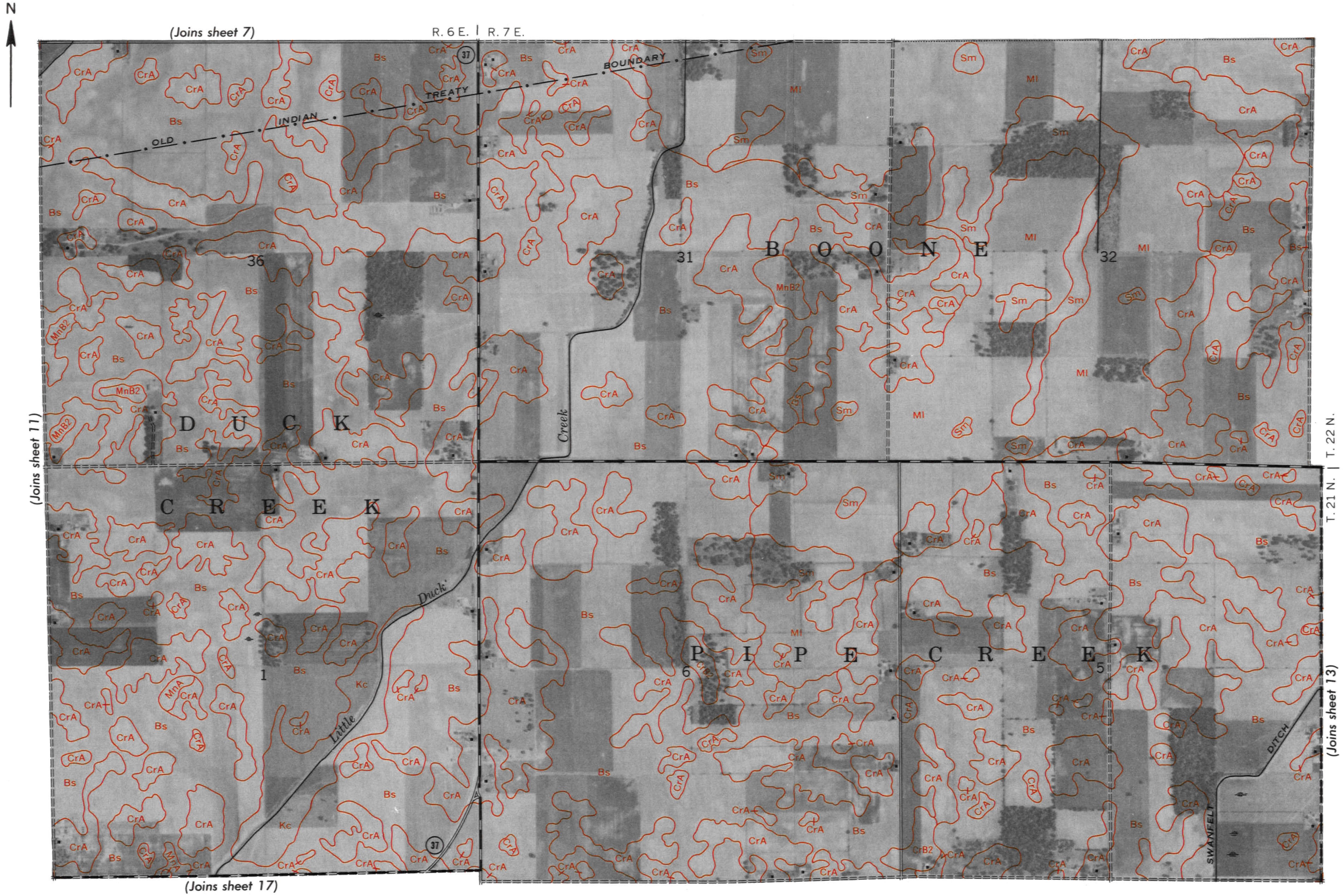

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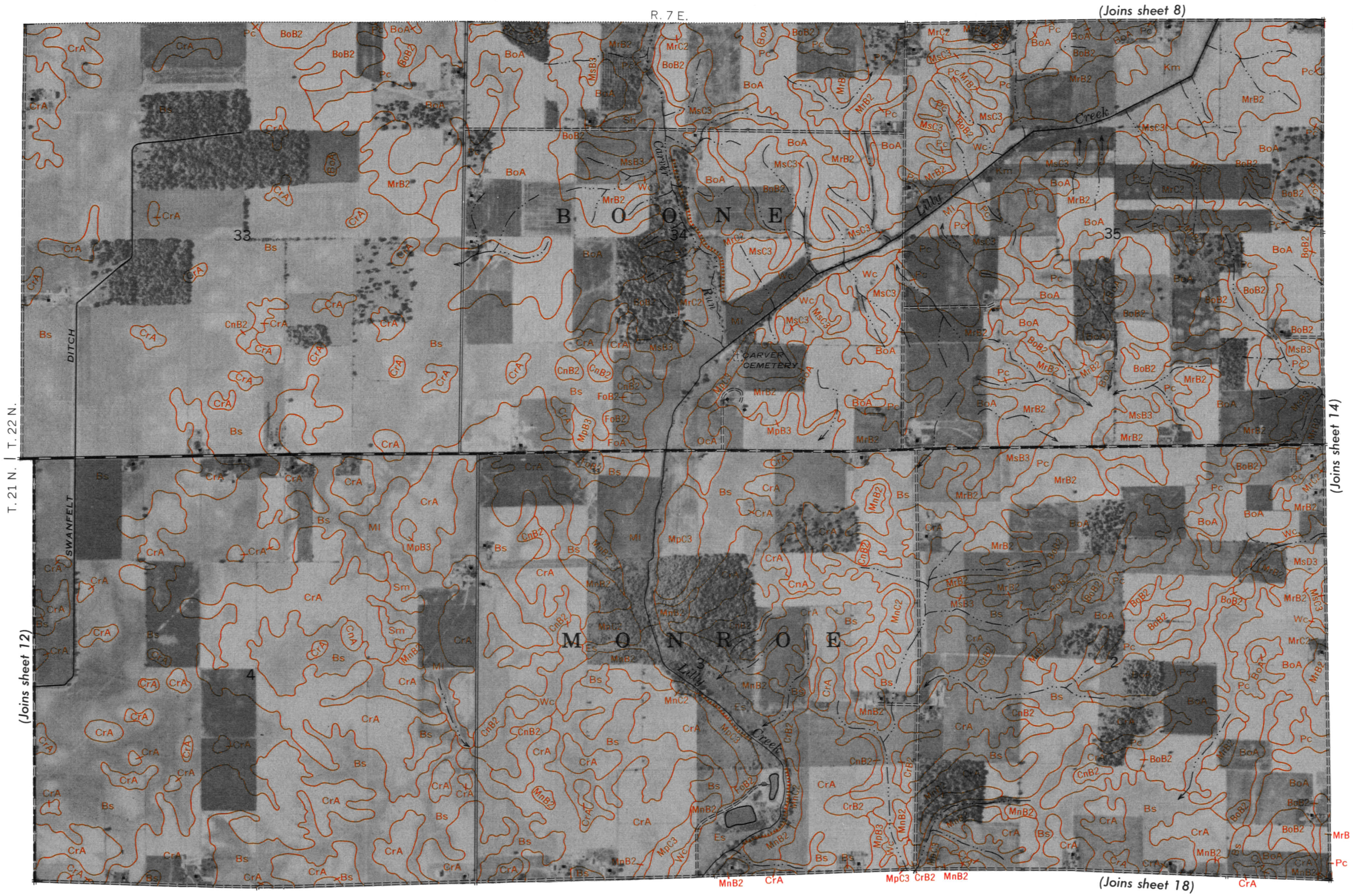

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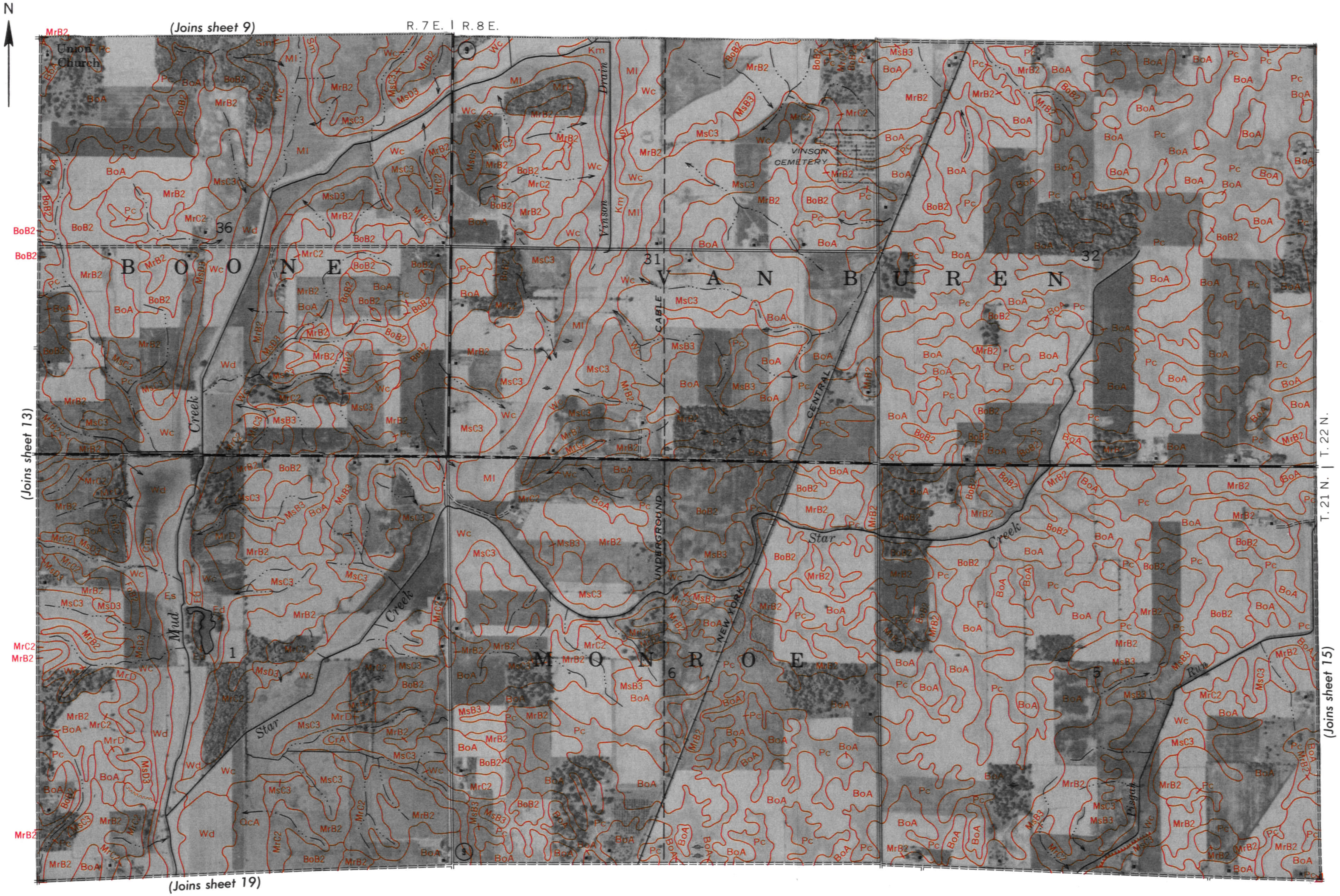

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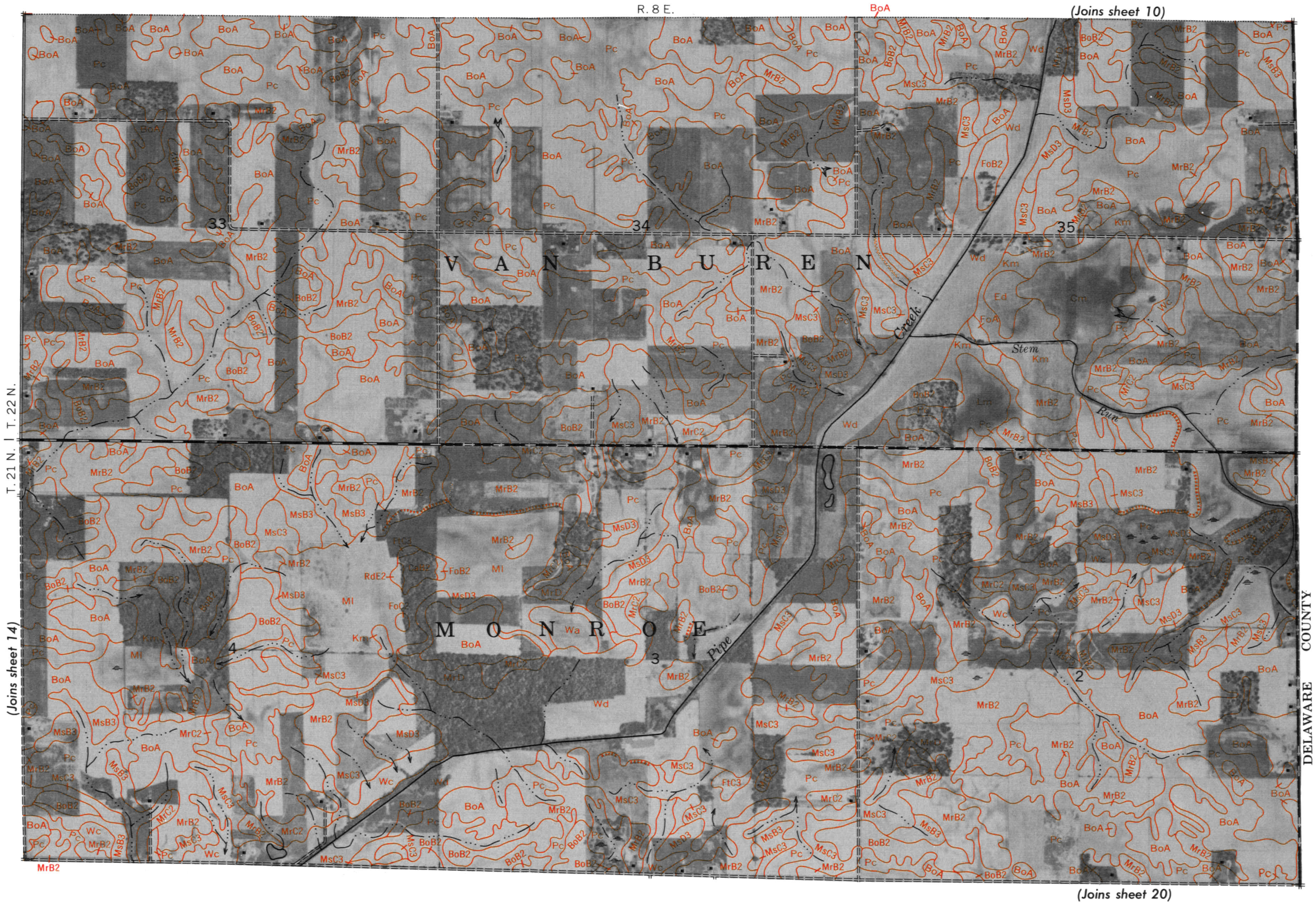

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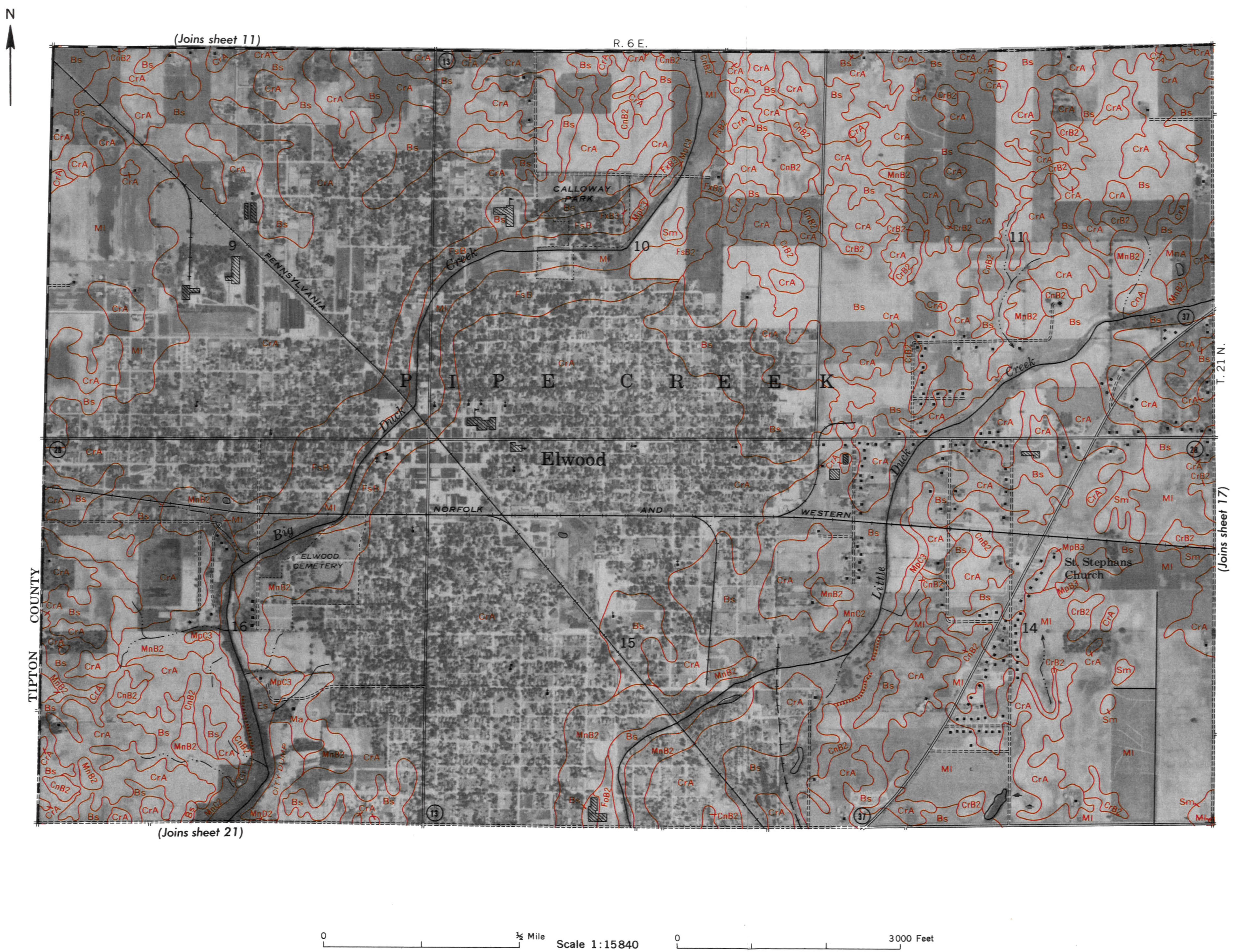

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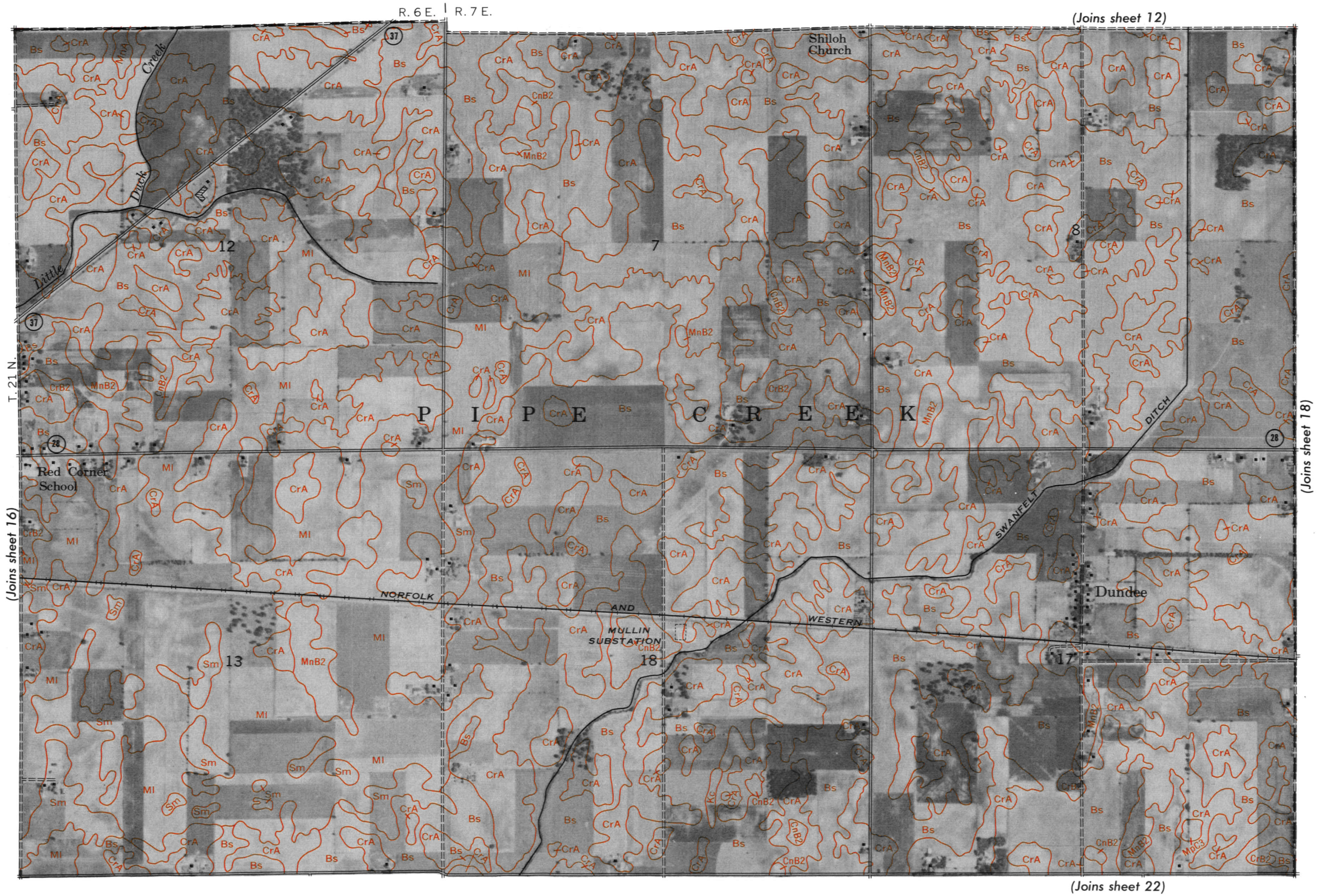

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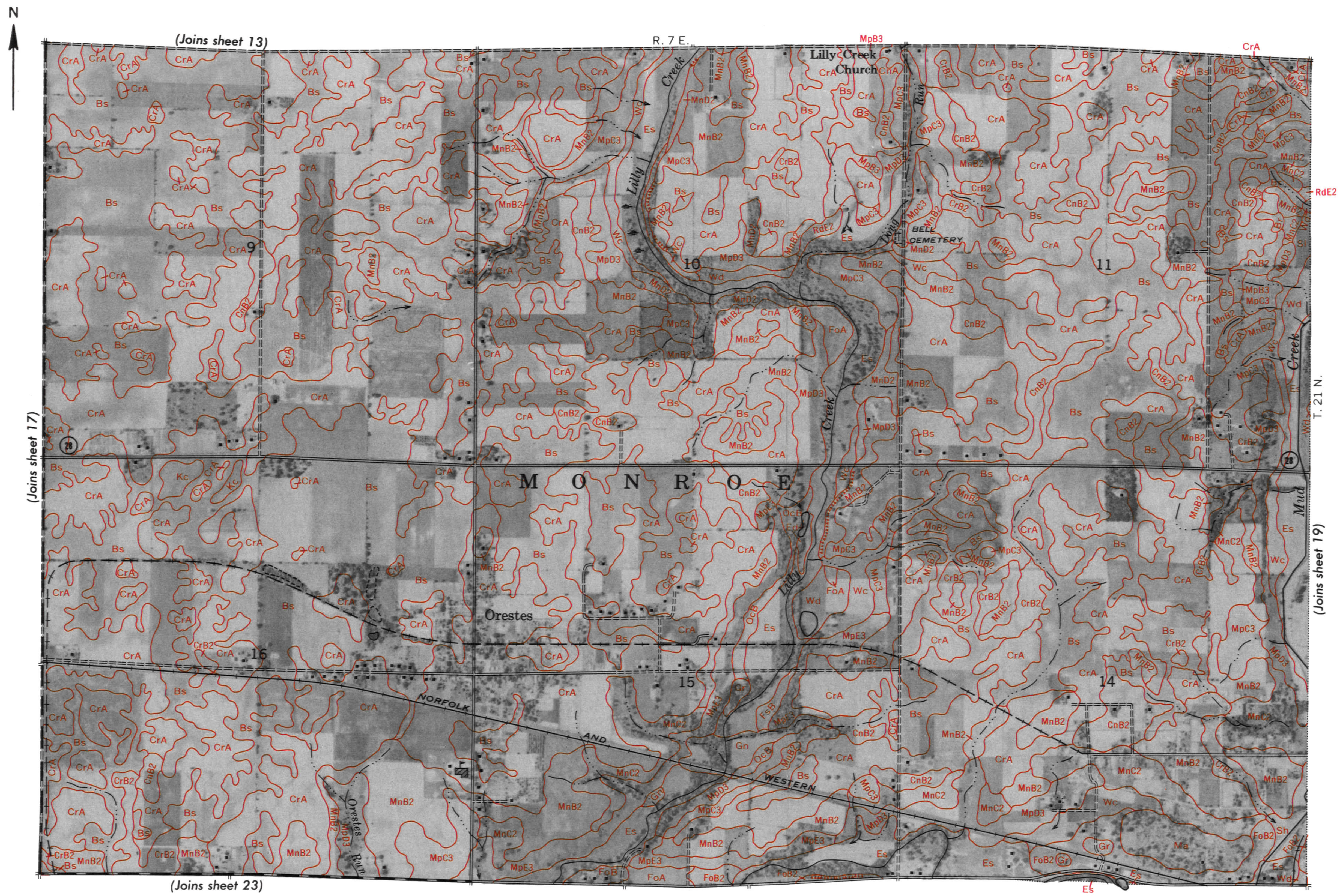
MADISON COUNTY, INDIANA — SHEET NUMBER 18

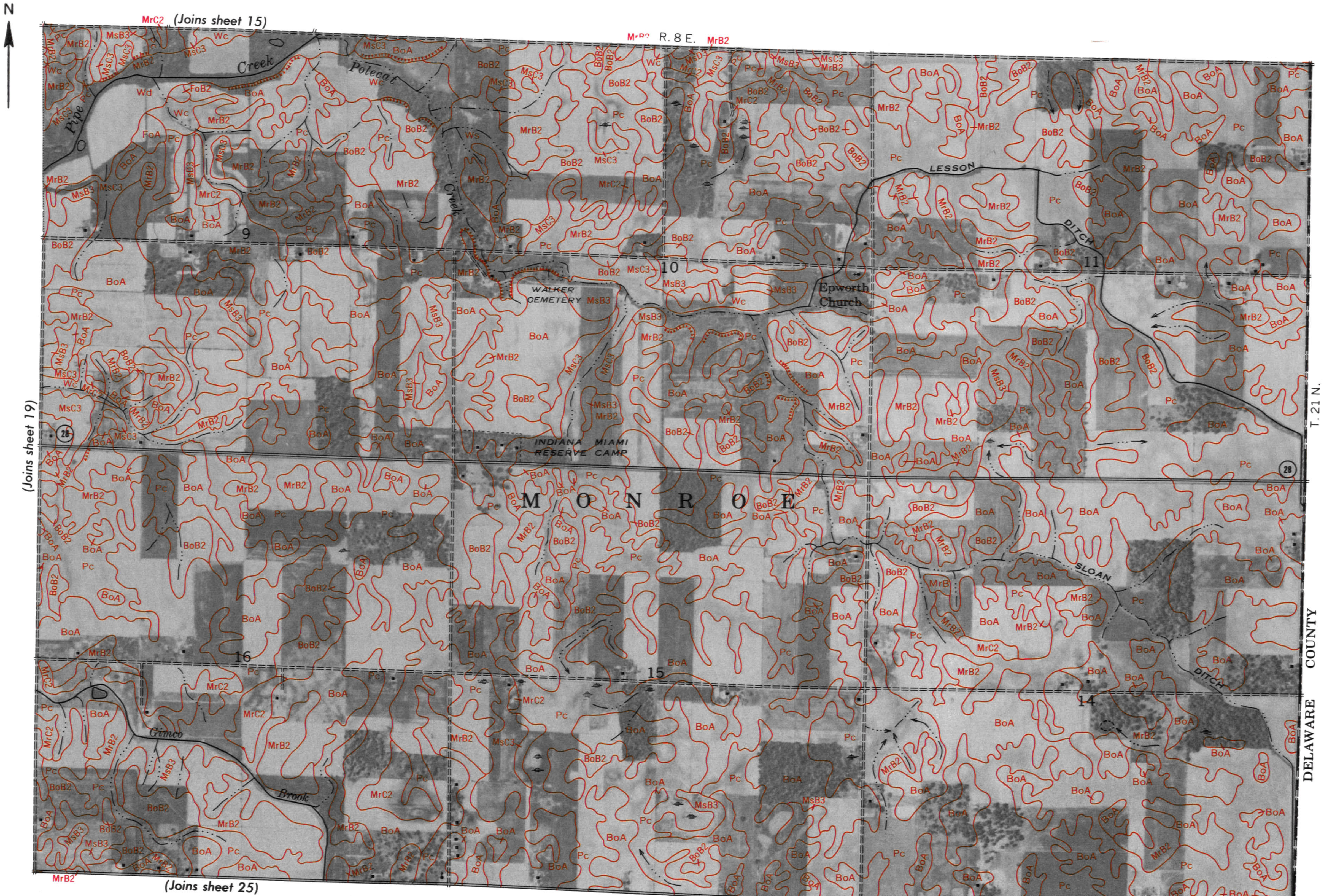


0 ½ Mile Scale 1:15840 0 3000 Feet

This map is one of a set compiled in 1966 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Purdue University Agricultural Experiment Station.

Range, township, and section corners shown on this map are indefinite.

0 ½ Mile Scale 1:15840 0 3000 Feet



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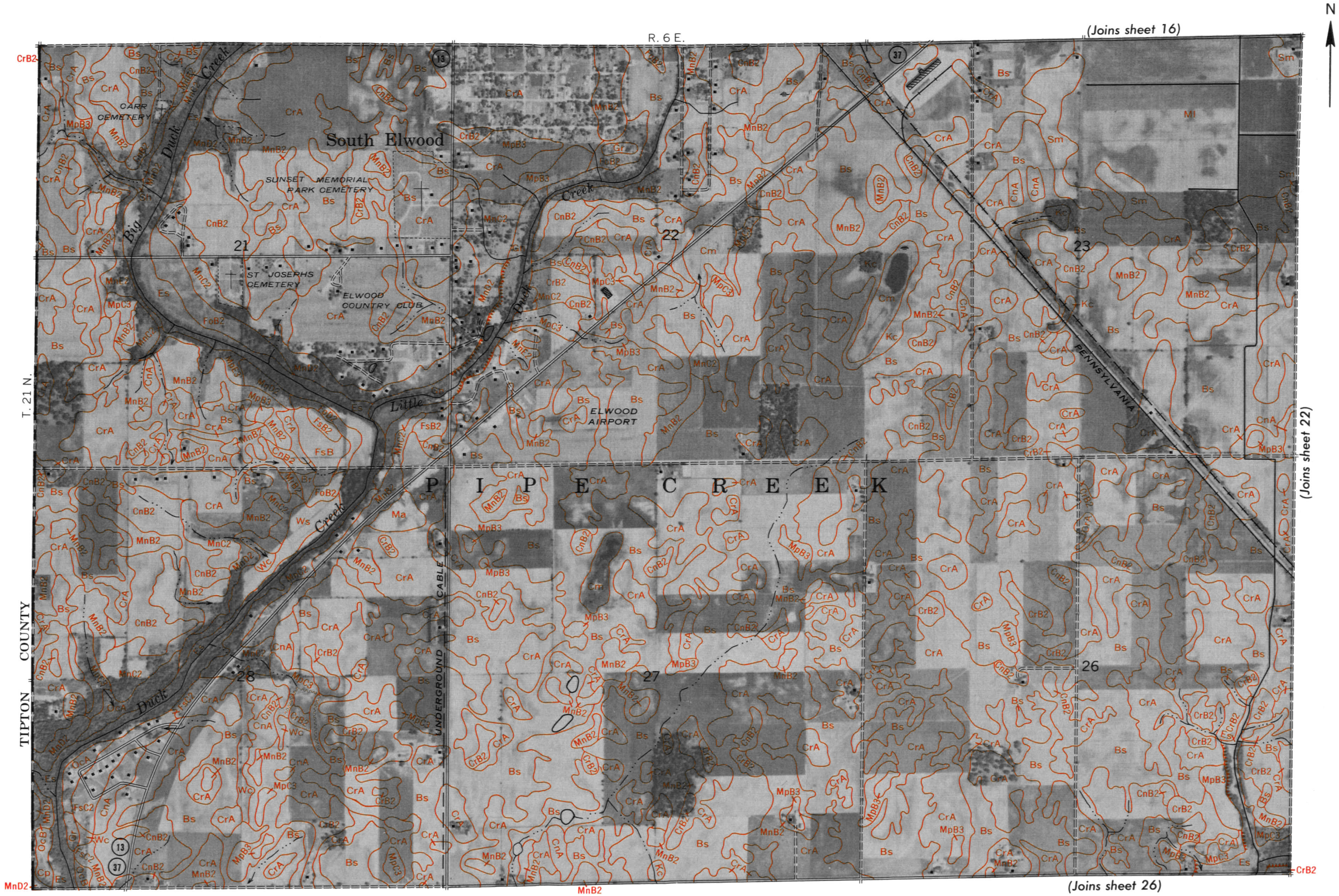
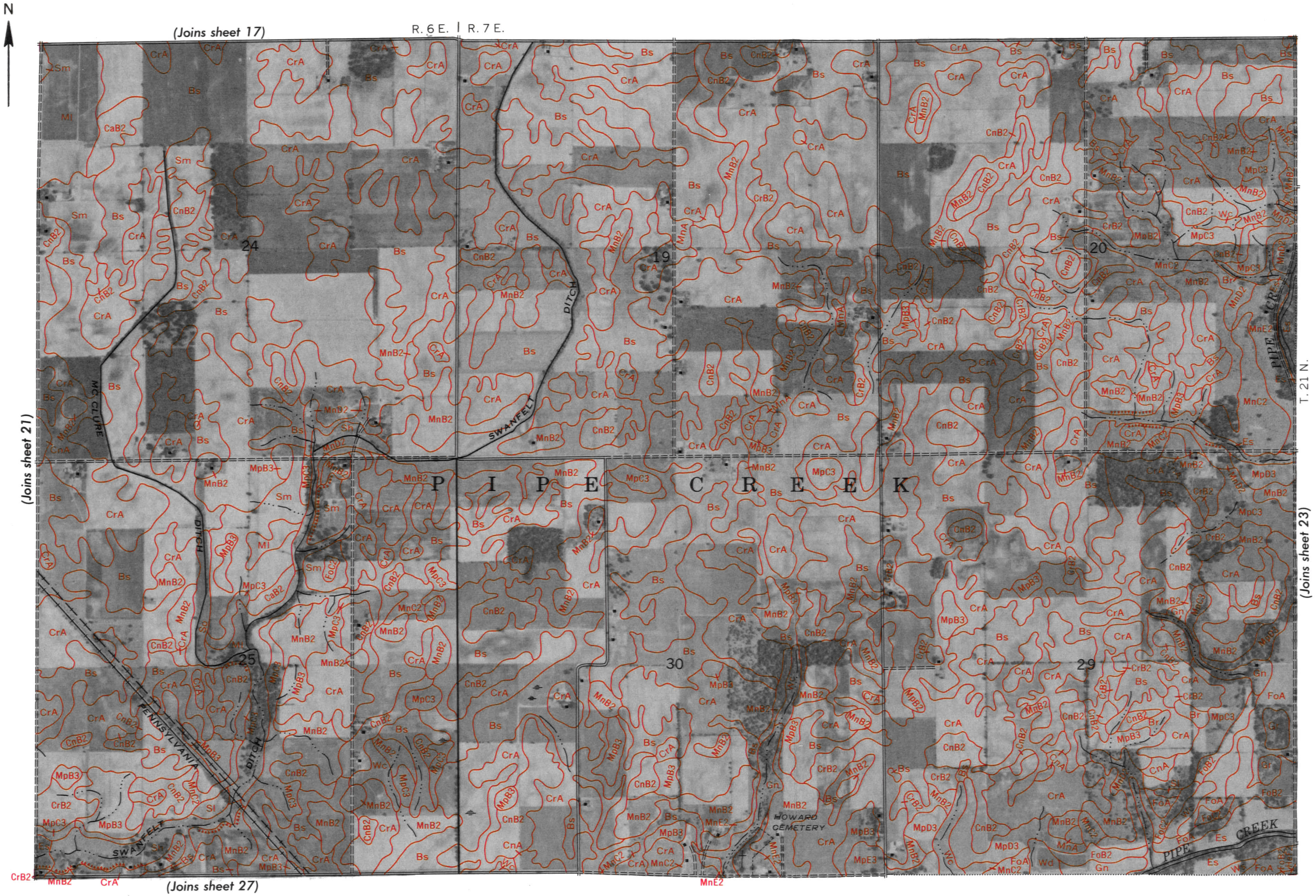


This map is one of a set compiled in 1966 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Purdue University Agricultural Experiment Station.

Range, township, and section corners shown on this map are indefinite.

0 ½ Mile Scale 1:15840 0 3000 Feet

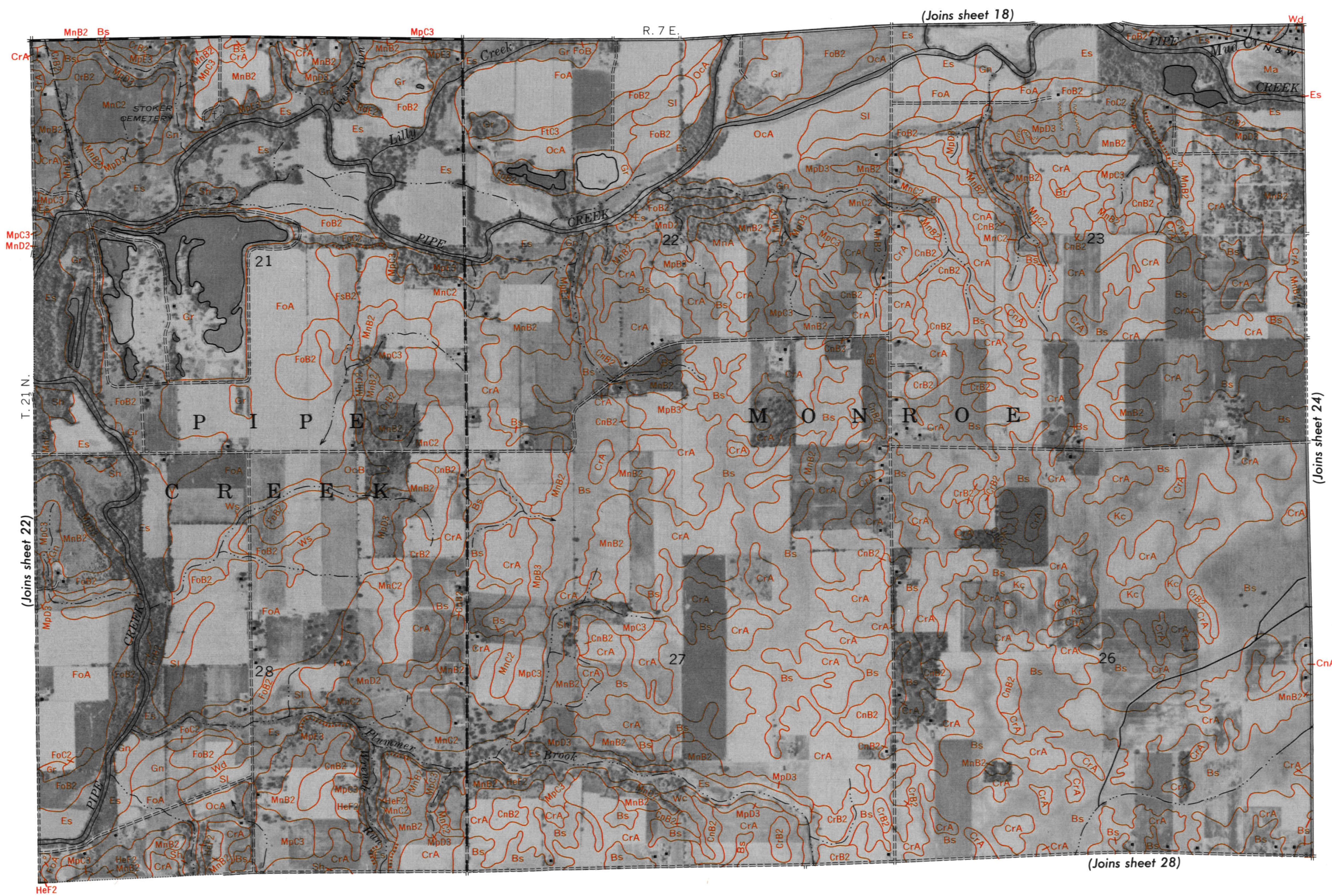
MADISON COUNTY, INDIANA — SHEET NUMBER 22



0 ½ Mile Scale 1:15840 0 3000 Feet

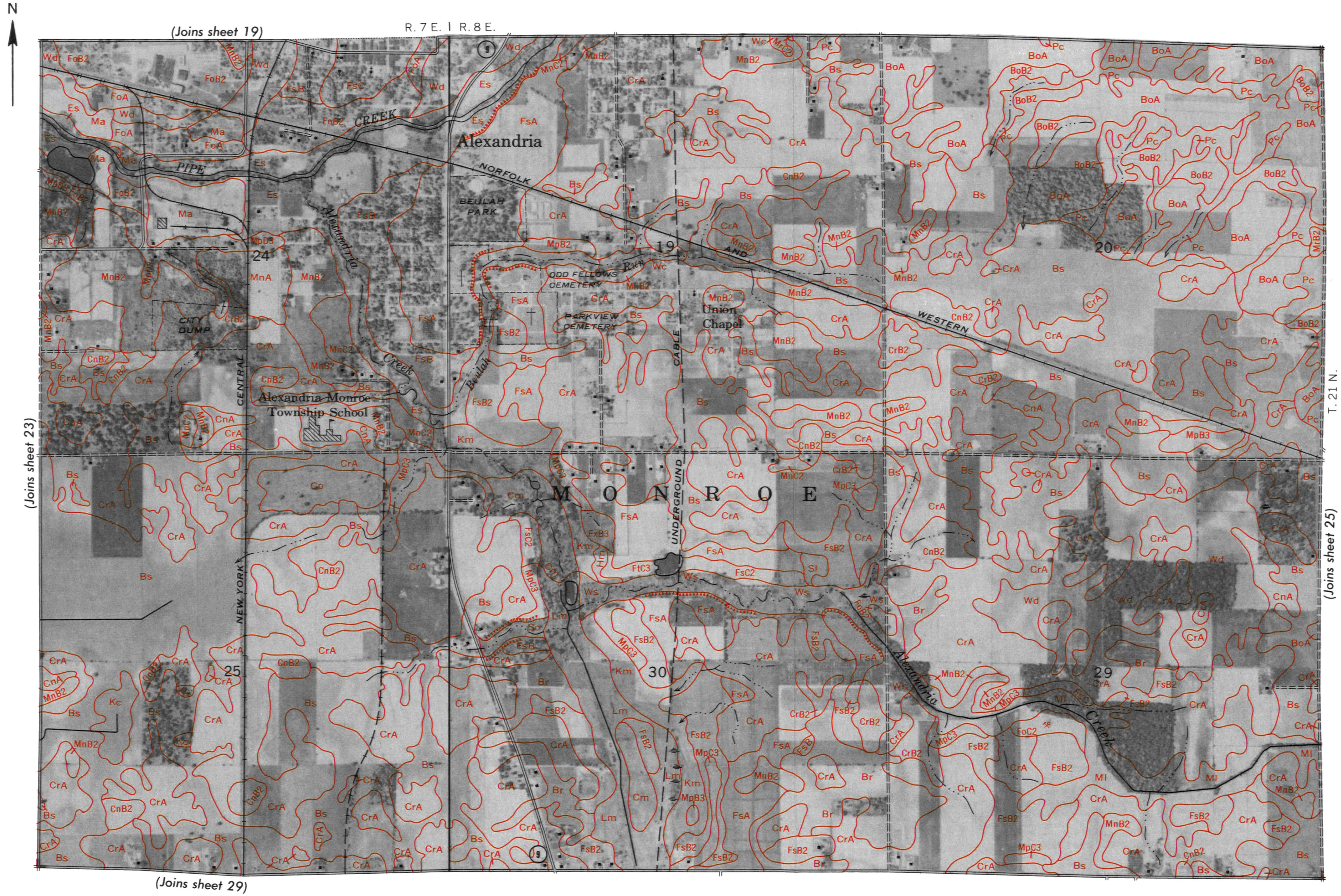
This map is one of a set compiled in 1966 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Purdue University Agricultural Experiment Station.

Range, township, and section corners shown on this map are indefinite.

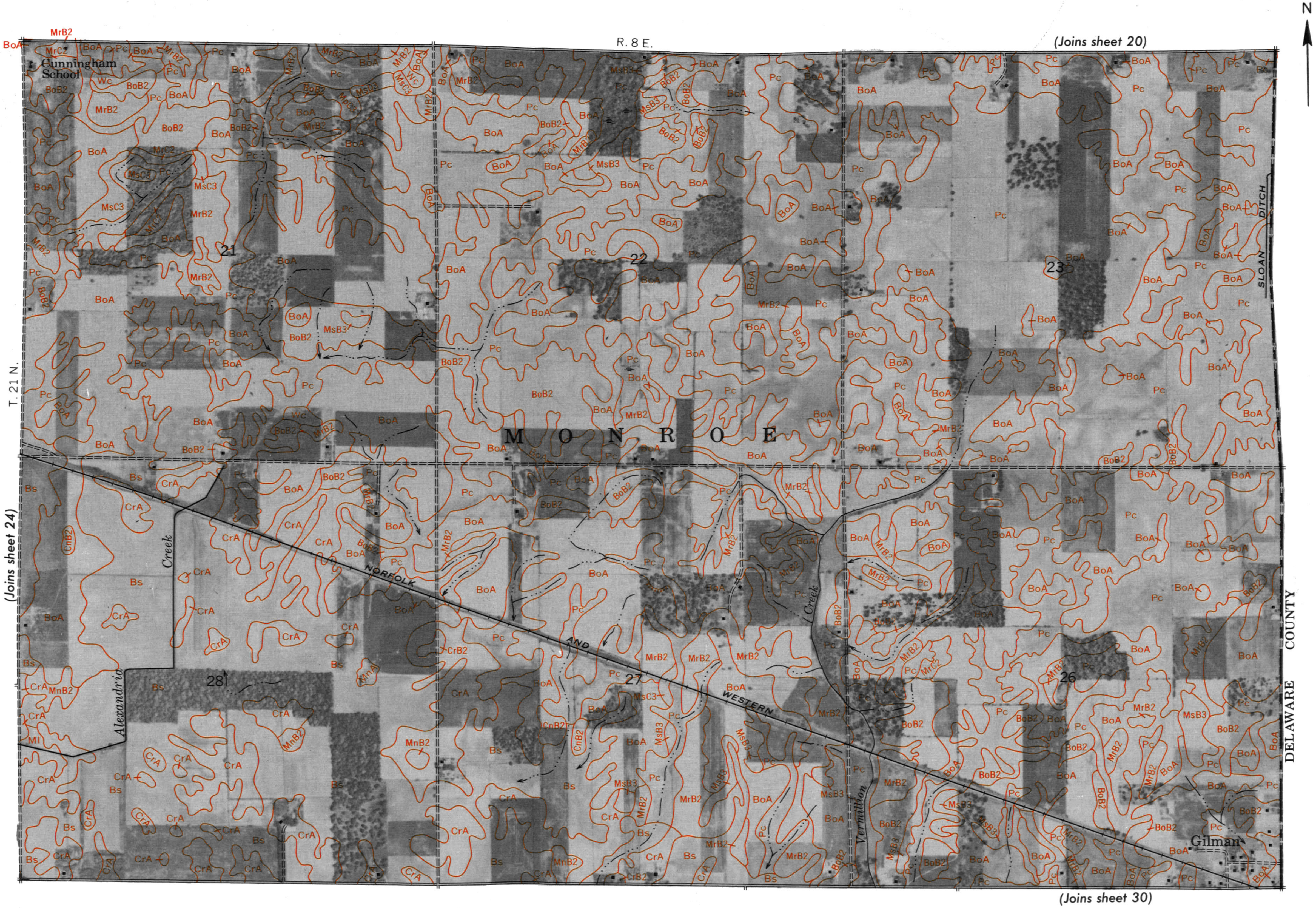


0 ½ Mile Scale 1:15840 0 3000 Feet

MADISON COUNTY, INDIANA — SHEET NUMBER 24



0 ½ Mile Scale 1:15840 0 3000 Feet

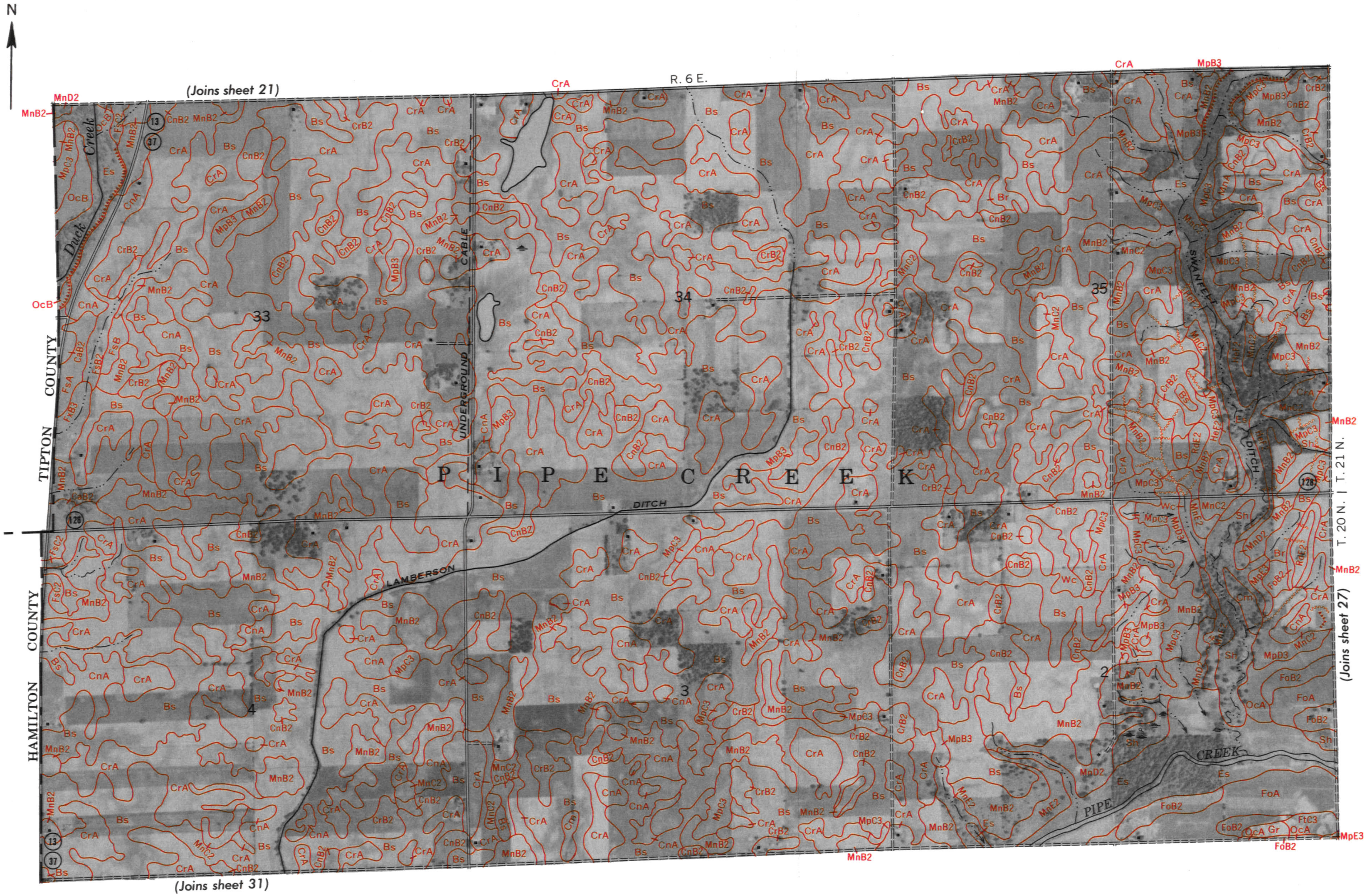


This map is one of a set compiled in 1966 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Purdue University Agricultural Experiment Station.

Range, township, and section corners shown on this map are indefinite.

0 ½ Mile Scale 1:15840 0 3000 Feet

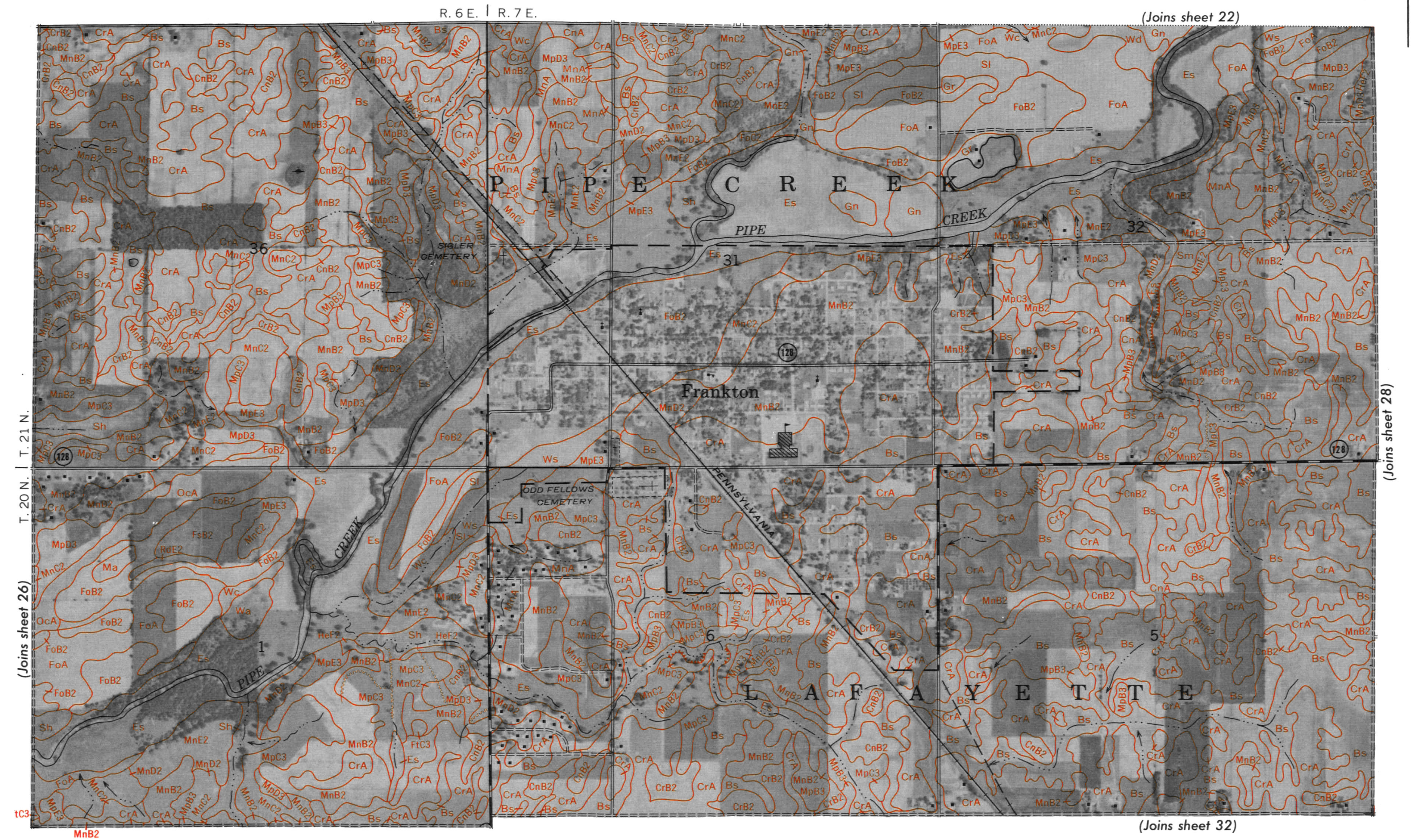
MADISON COUNTY, INDIANA — SHEET NUMBER 26



0 ½ Mile Scale 1:15840 0 3000 Feet

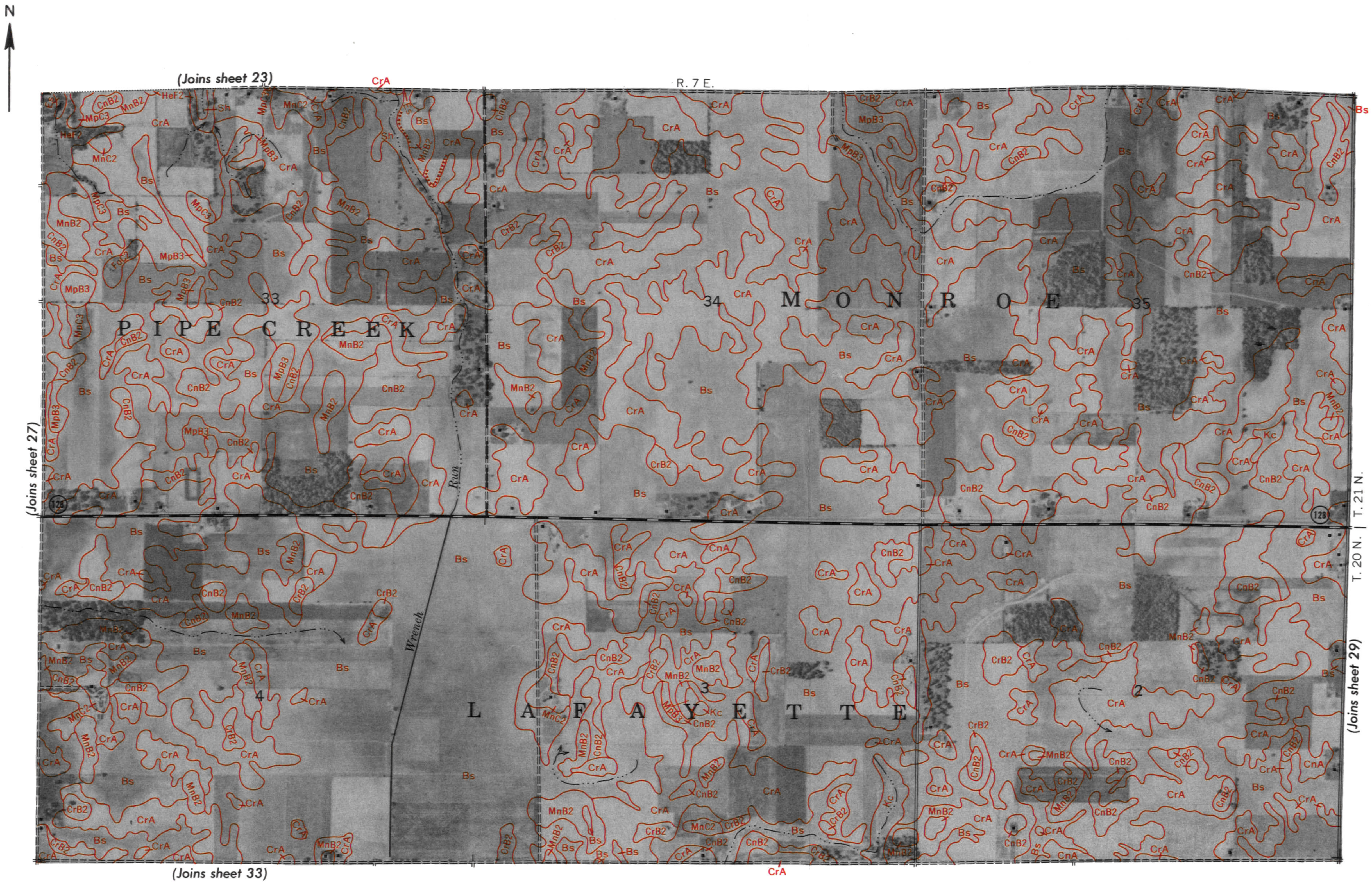
This map is one of a set compiled in 1966 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Purdue University Agricultural Experiment Station.

Range, township, and section corners shown on this map are indefinite.



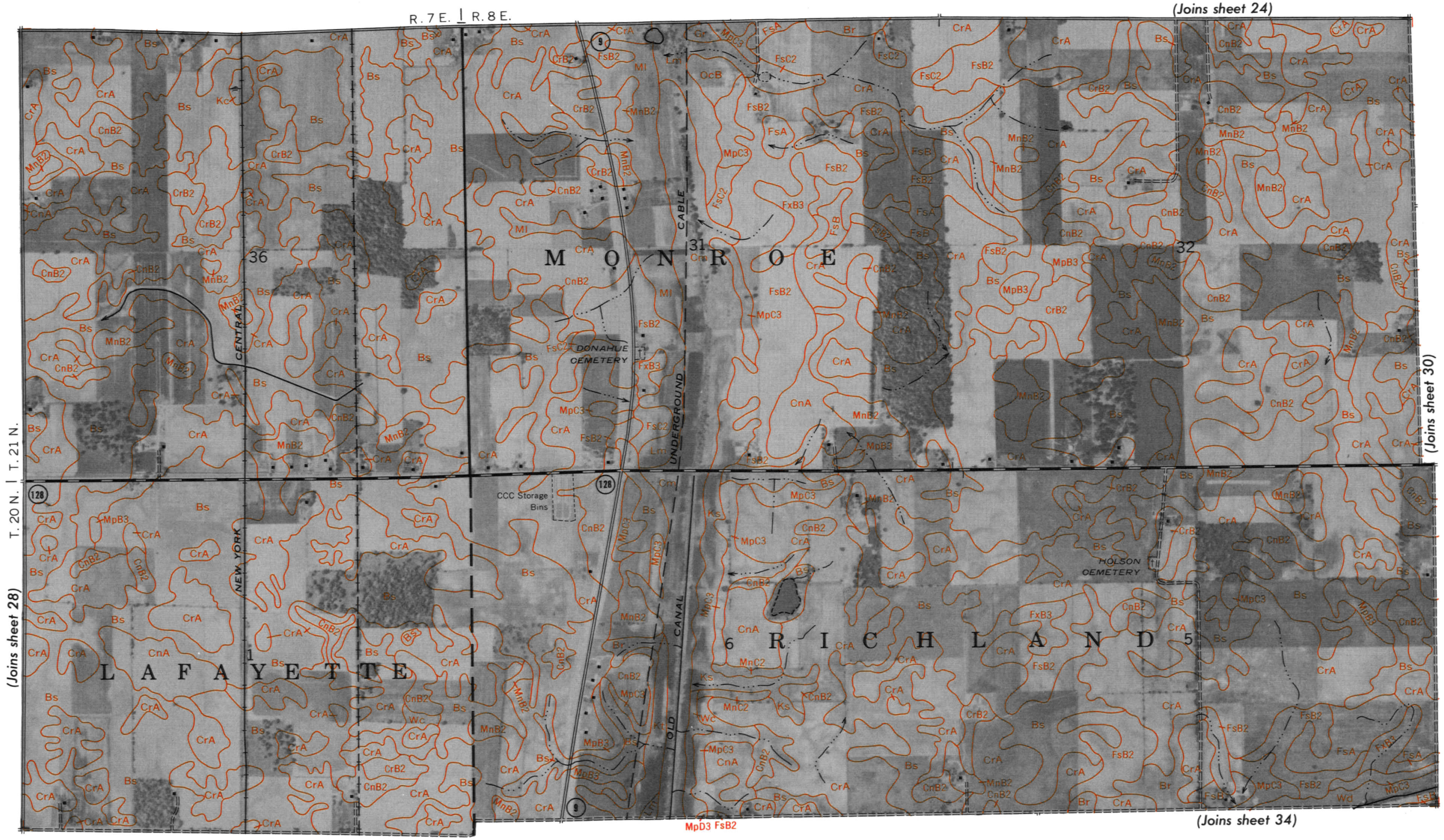
0 ½ Mile Scale 1:15840 0 3000 Feet

MADISON COUNTY, INDIANA — SHEET NUMBER 28



0 ½ Mile Scale 1:15840 0 3000 Feet

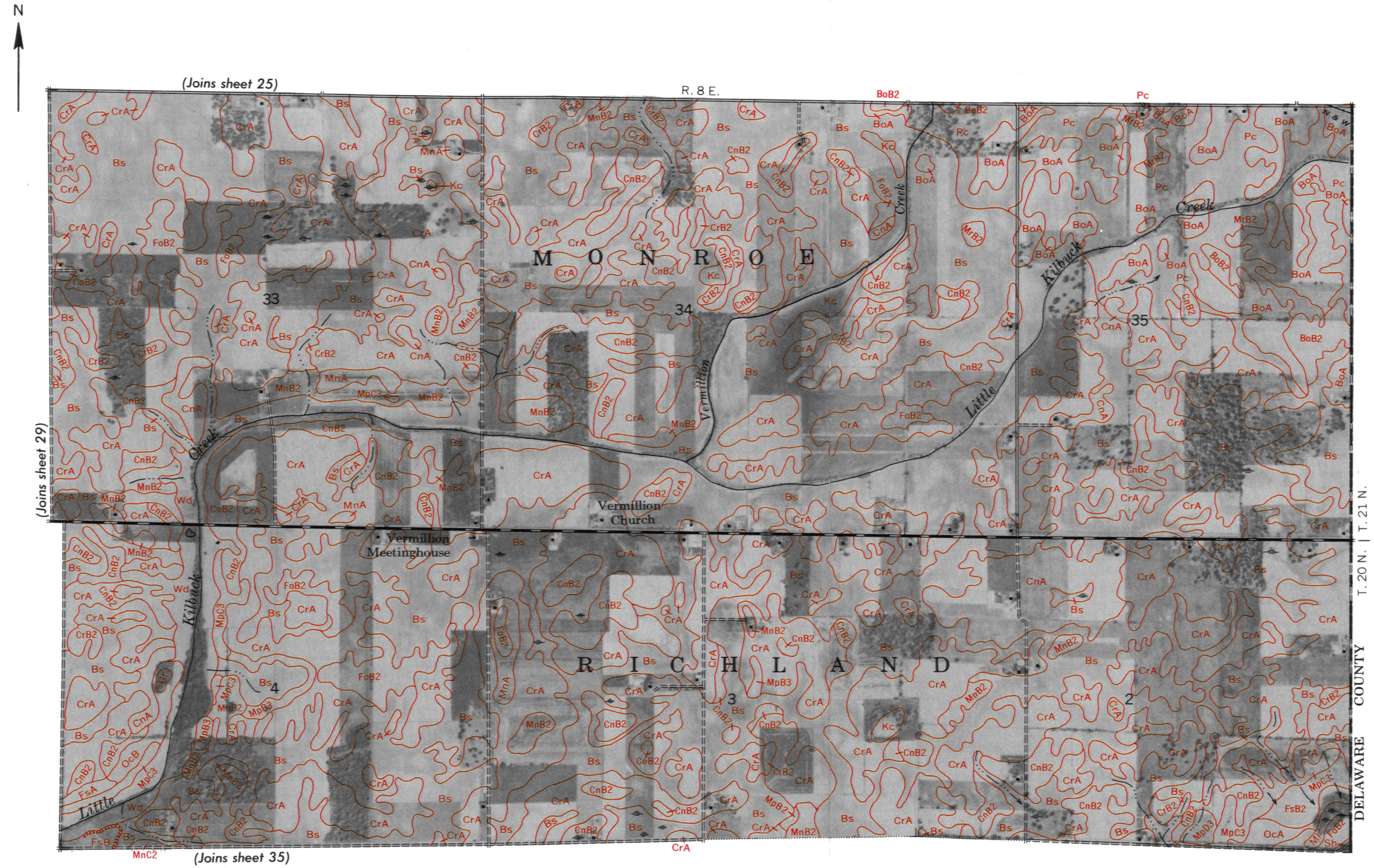
N



0 ½ Mile Scale 1:15840 0 3000 Feet

This map is one of a set compiled in 1966 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Purdue University Agricultural Experiment Station.

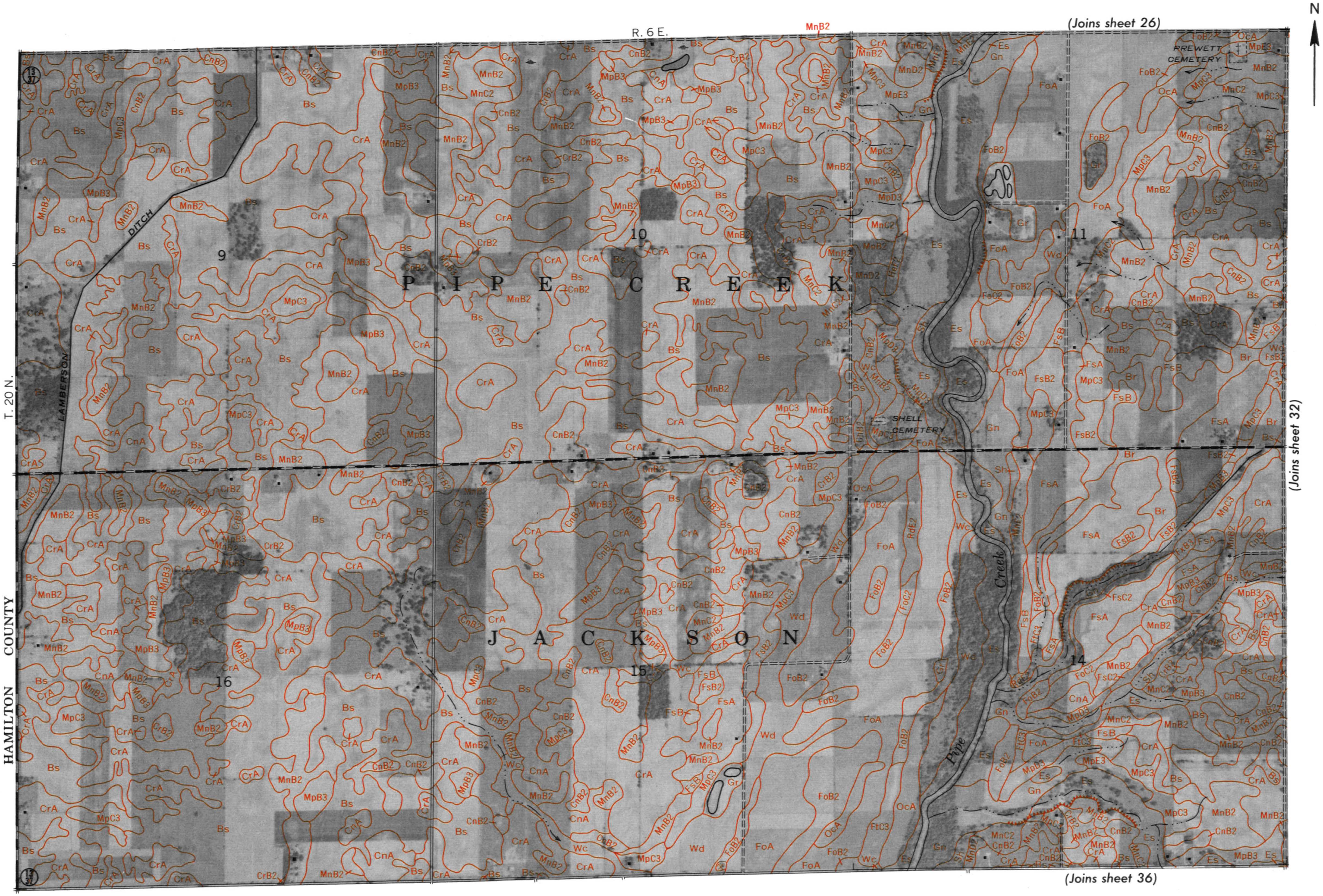
Range, township, and section corners shown on this map are indefinite.



0 ½ Mile Scale 1:15840 0 3000 Feet

This map is one of a set compiled in 1966 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Purdue University Agricultural Experiment Station.

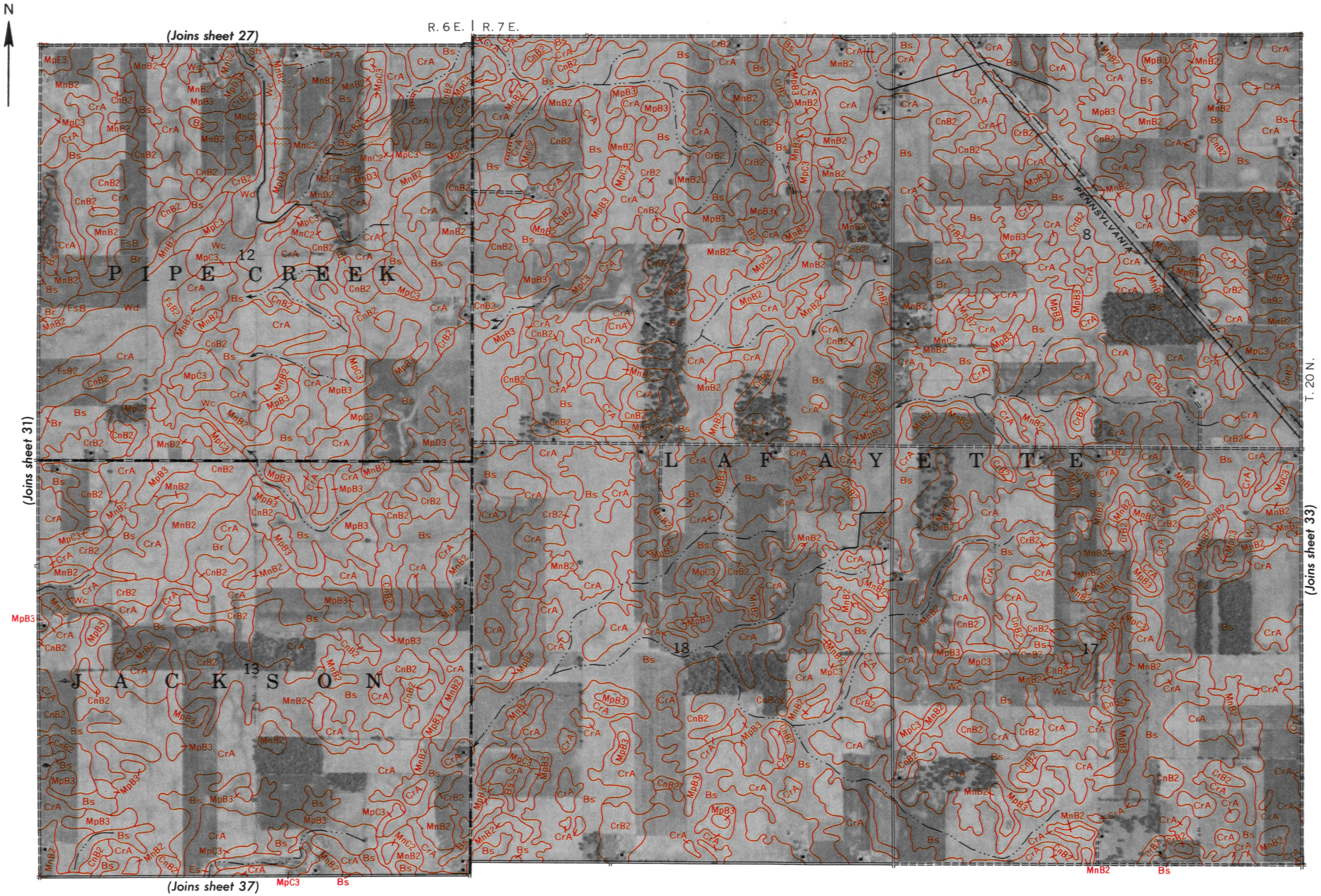
Range, township, and section corners shown on this map are indefinite.



0 ½ Mile Scale 1:15840 0 3000 Feet

MADISON COUNTY, INDIANA — SHEET NUMBER 32

32



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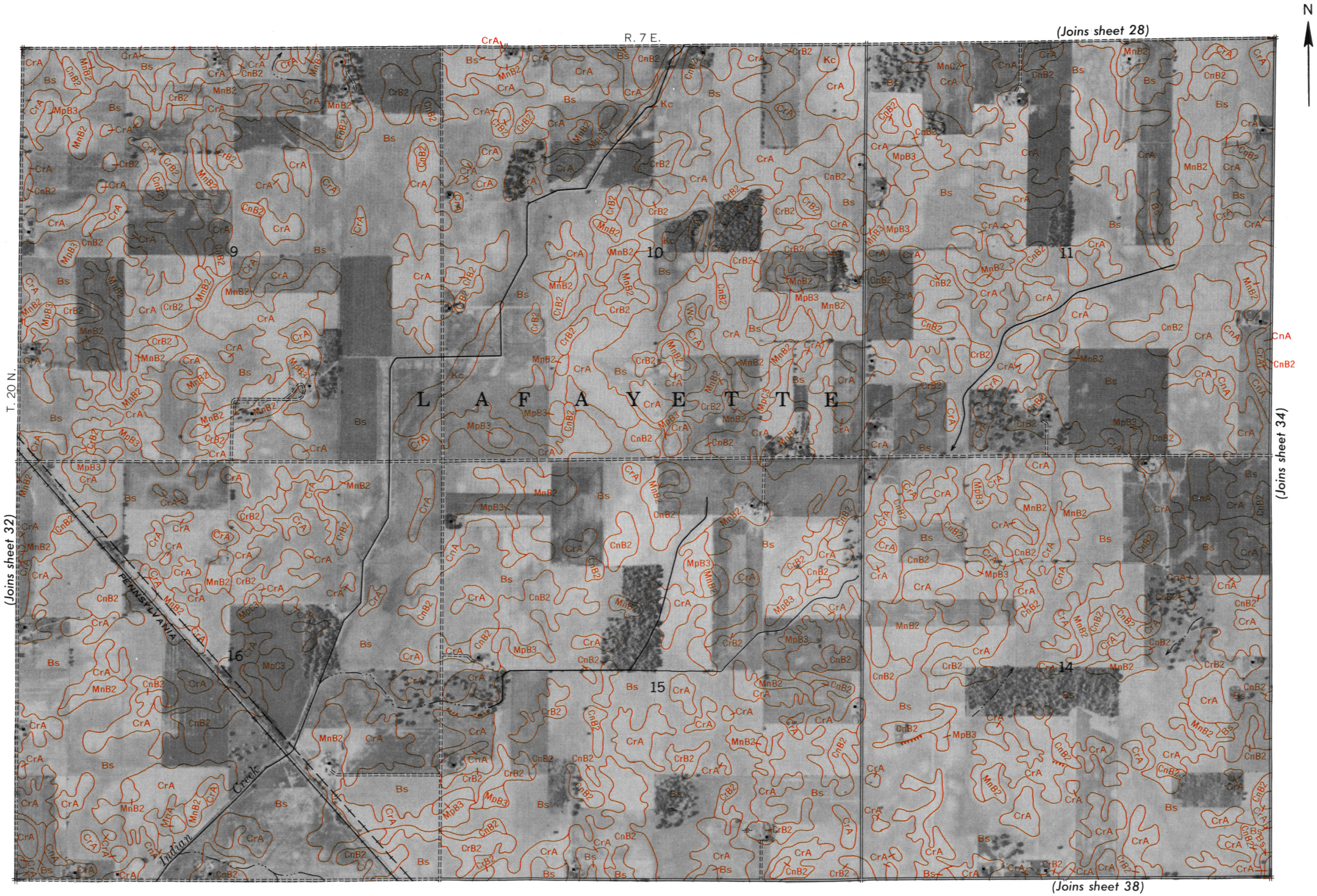
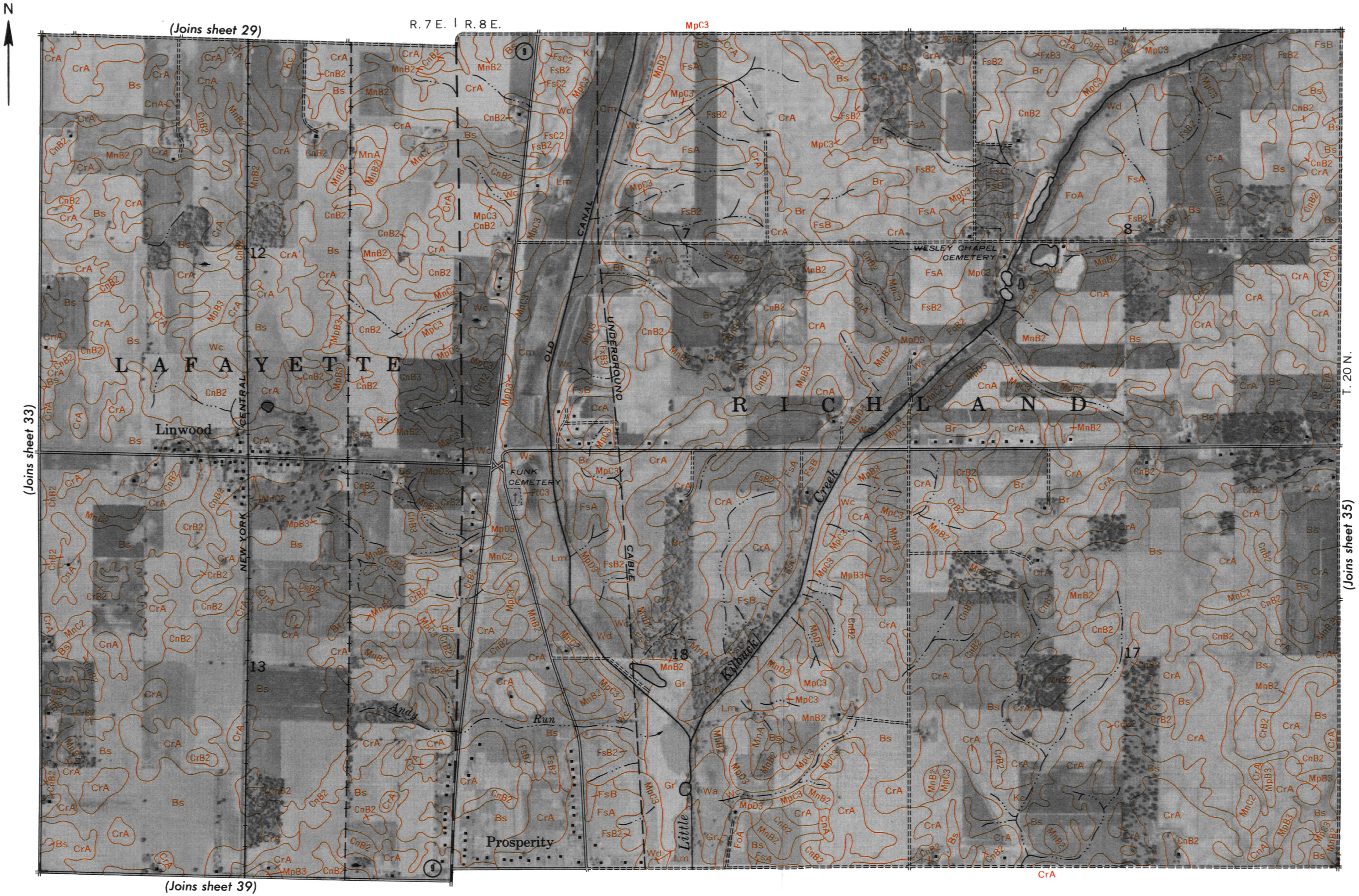


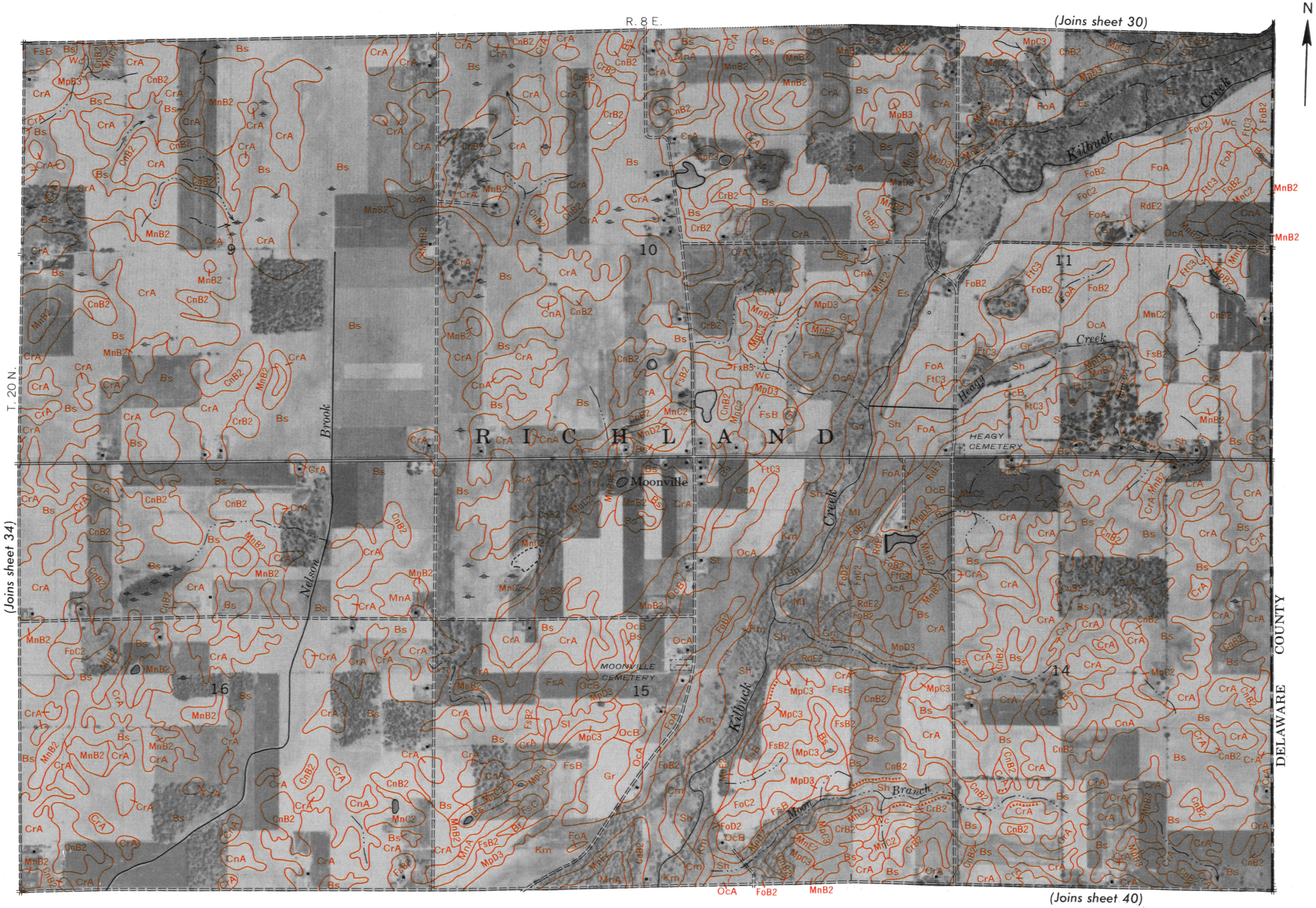
0 ½ Mile Scale 1:15840 0 3000 Feet

This map is one of a set compiled in 1966 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Purdue University Agricultural Experiment Station.

Range, township, and section corners shown on this map are indefinite.



0 ½ Mile Scale 1:15840 0 3000 Feet



This map is one of a set compiled in 1966 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Purdue University Agricultural Experiment Station.

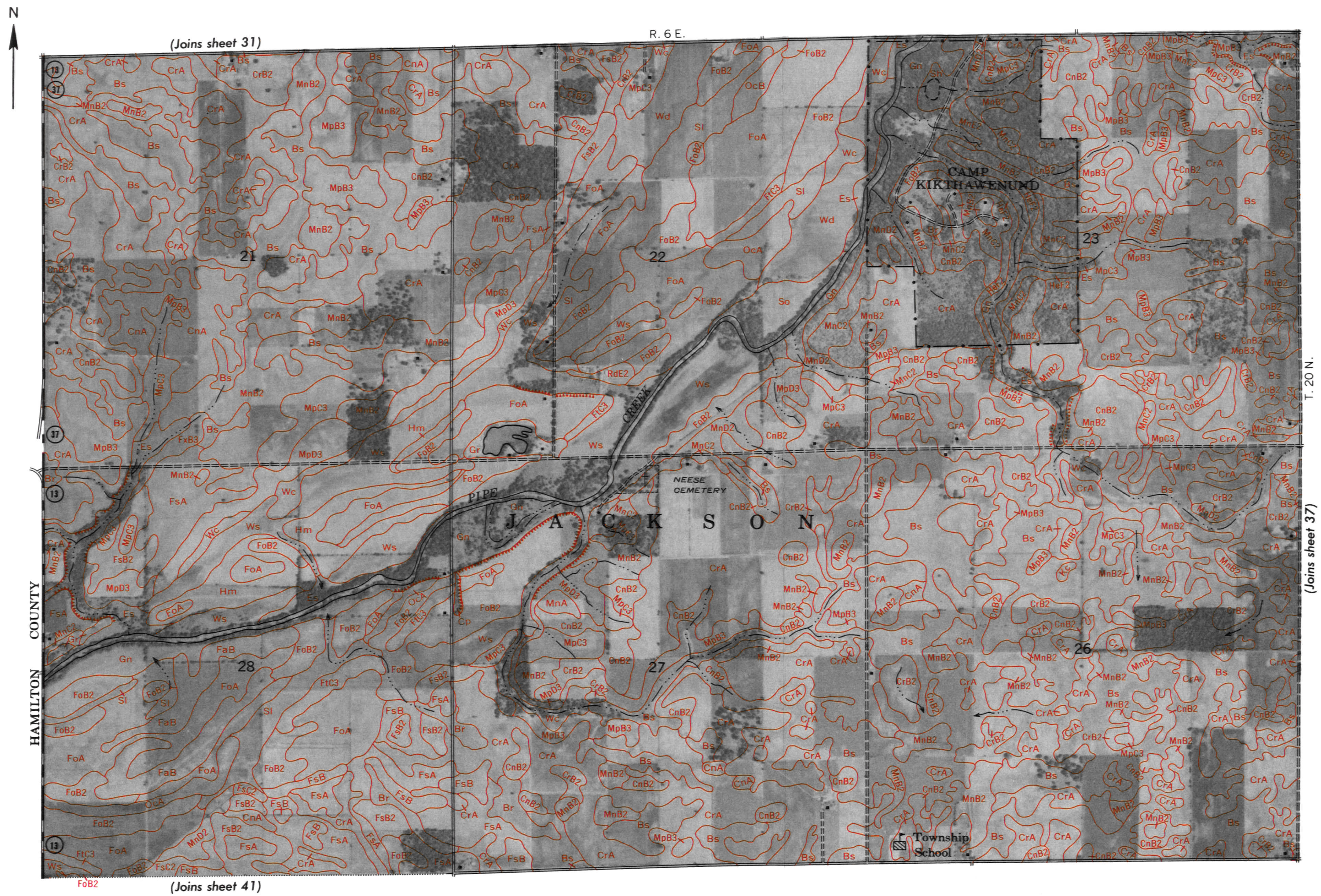
Range, township, and section corners shown on this map are indefinite.

Scale 1:15840

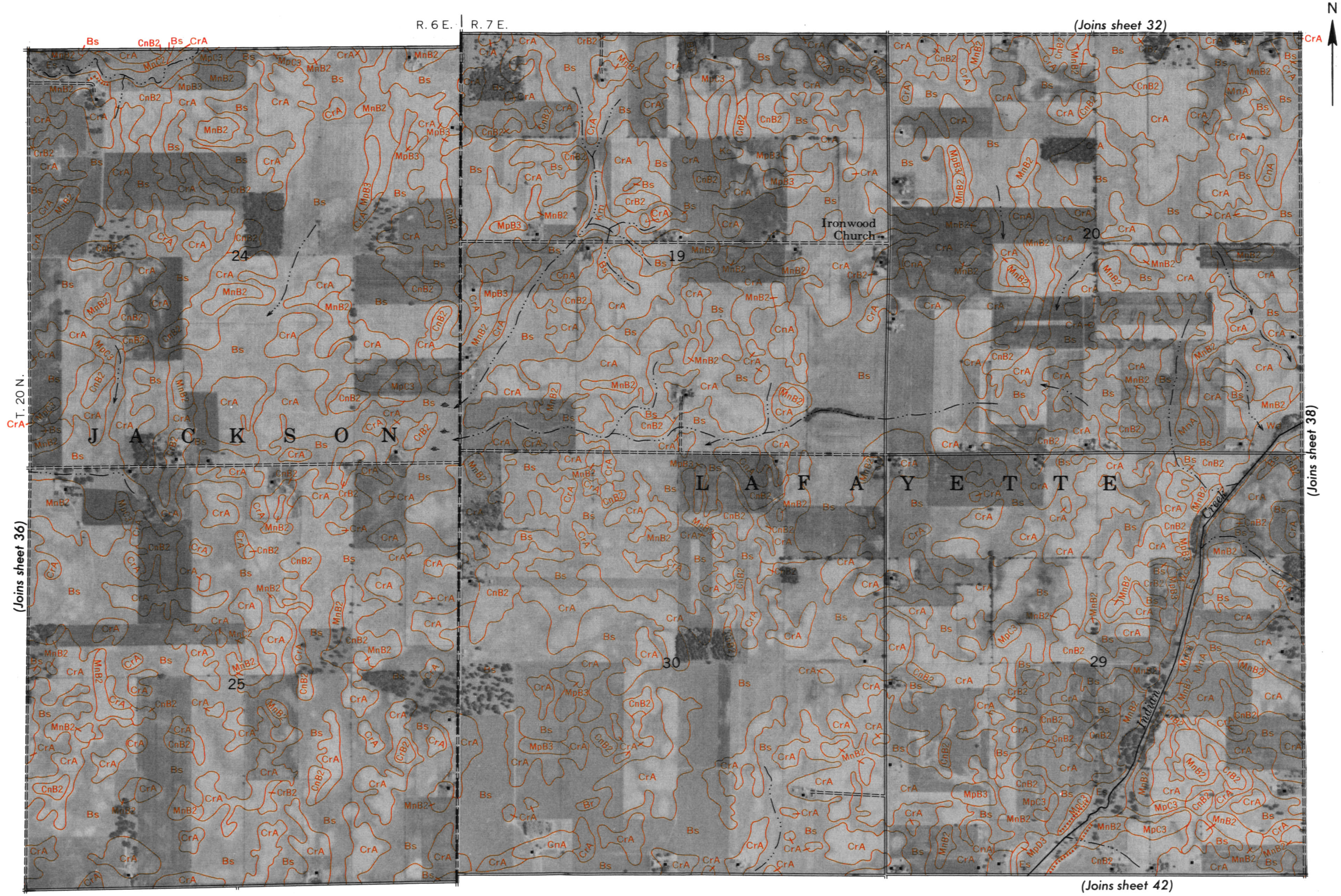
0 ½ Mile

0 3000 Feet

MADISON COUNTY, INDIANA — SHEET NUMBER 36



0 ½ Mile Scale 1:15840 0 3000 Feet

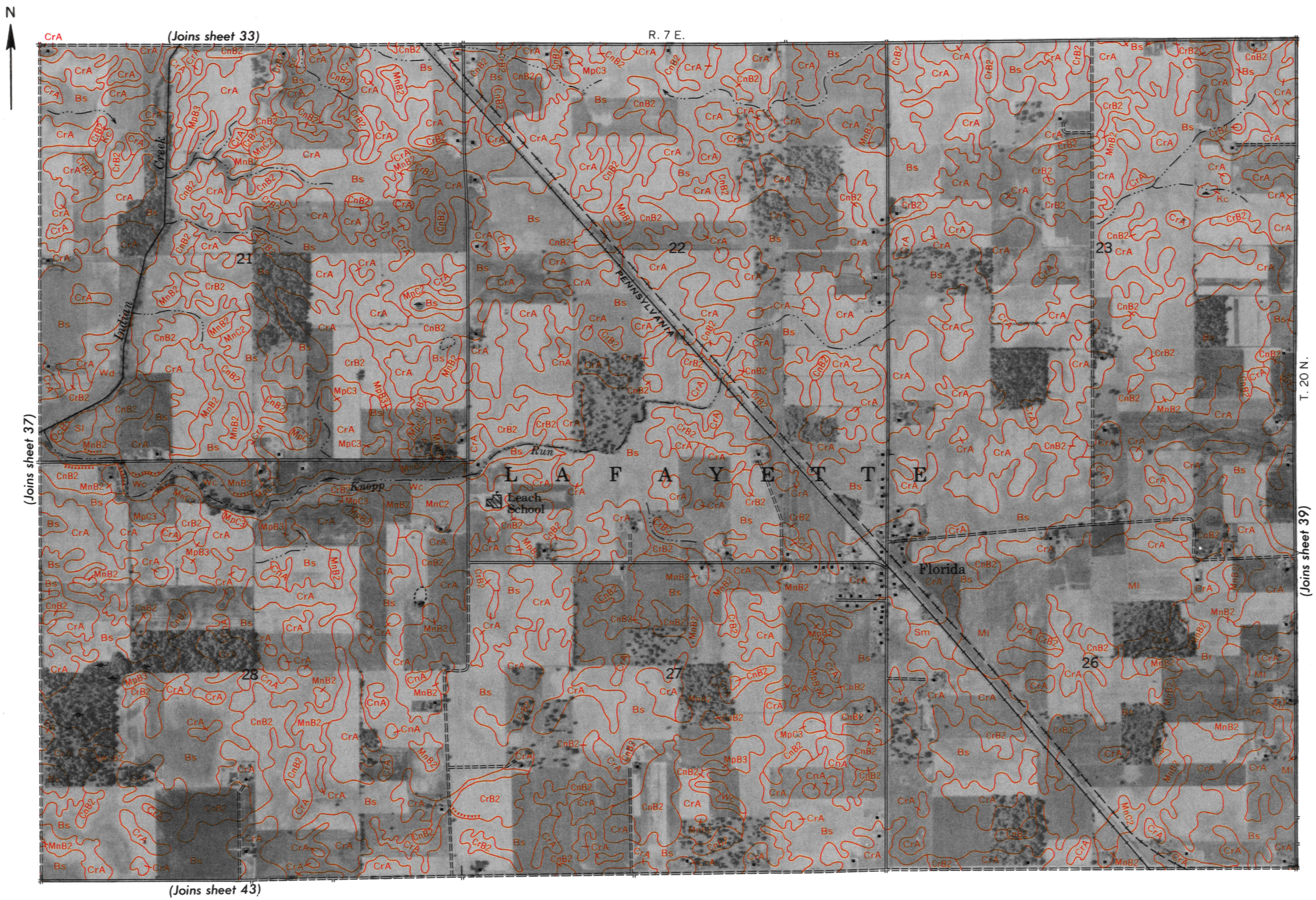


0 ½ Mile Scale 1:15840 0 3000 Feet

This map is one of a set compiled in 1966 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Purdue University Agricultural Experiment Station.

Range, township, and section corners shown on this map are indefinite.

MADISON COUNTY, INDIANA — SHEET NUMBER 38

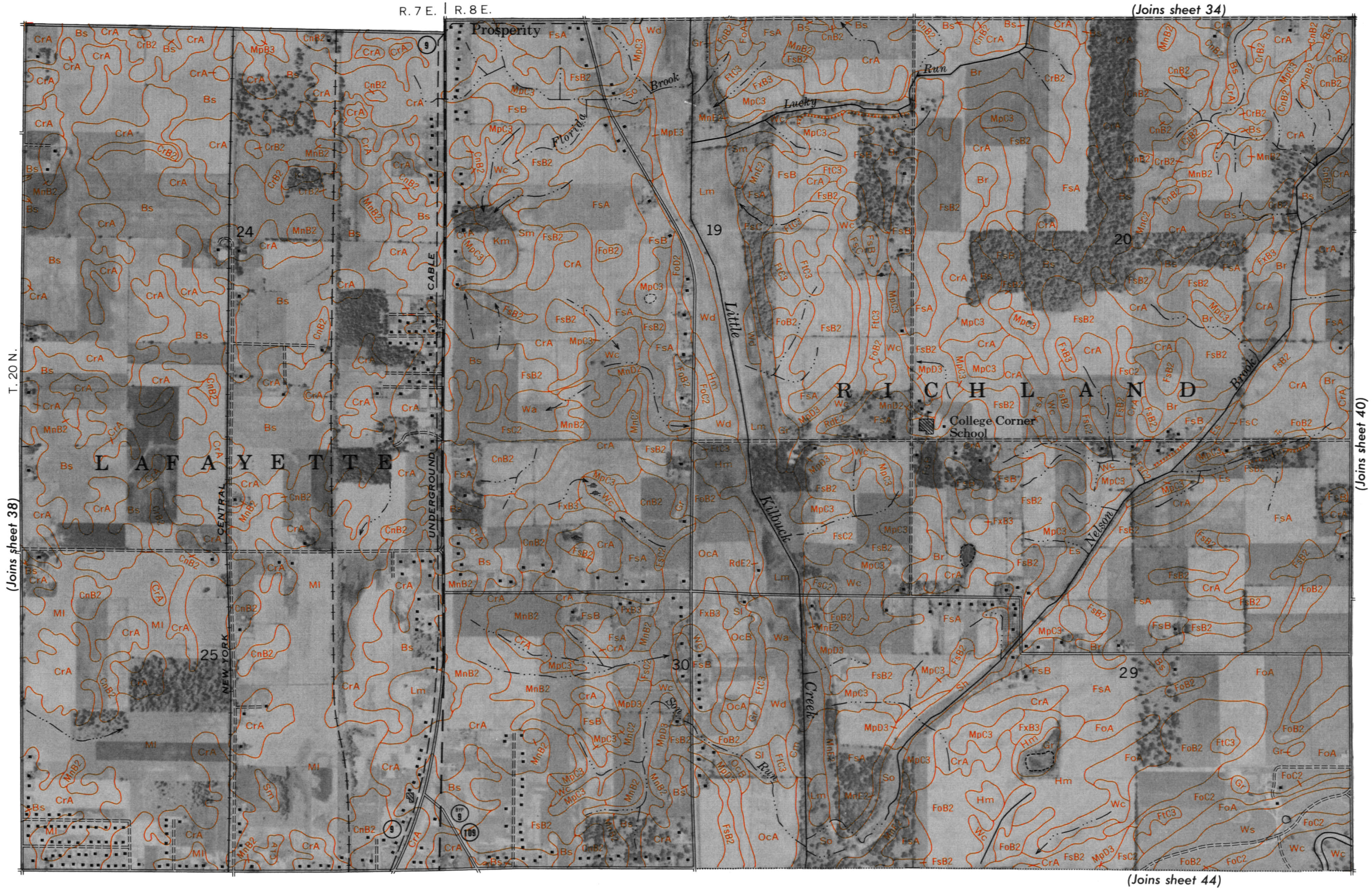


0 ½ Mile Scale 1:15840 0 3000 Feet

This map is one of a set compiled in 1966 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Purdue University Agricultural Experiment Station.

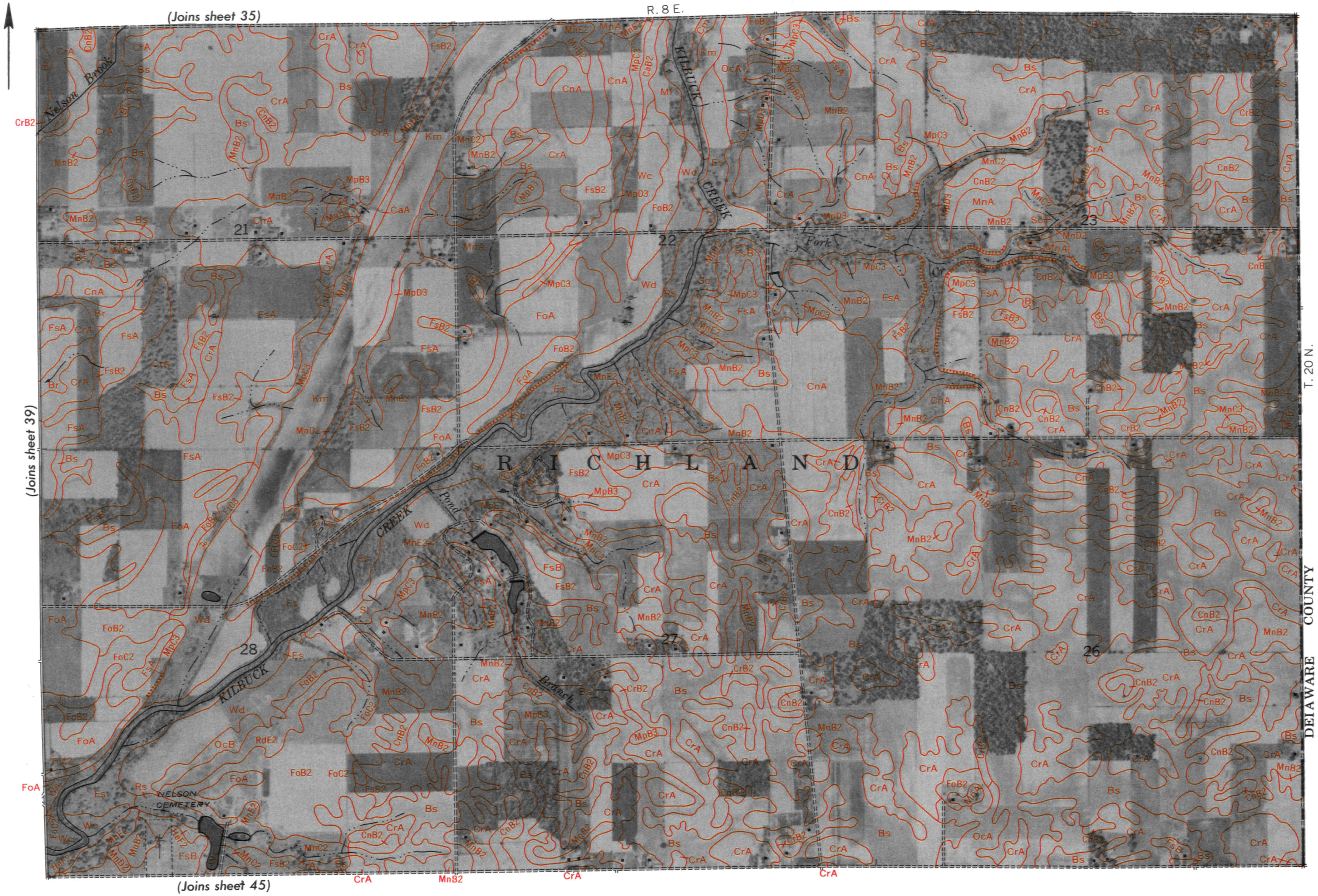
Range, township, and section corners shown on this map are indefinite.

N



0 ½ Mile Scale 1:15840 0 3000 Feet

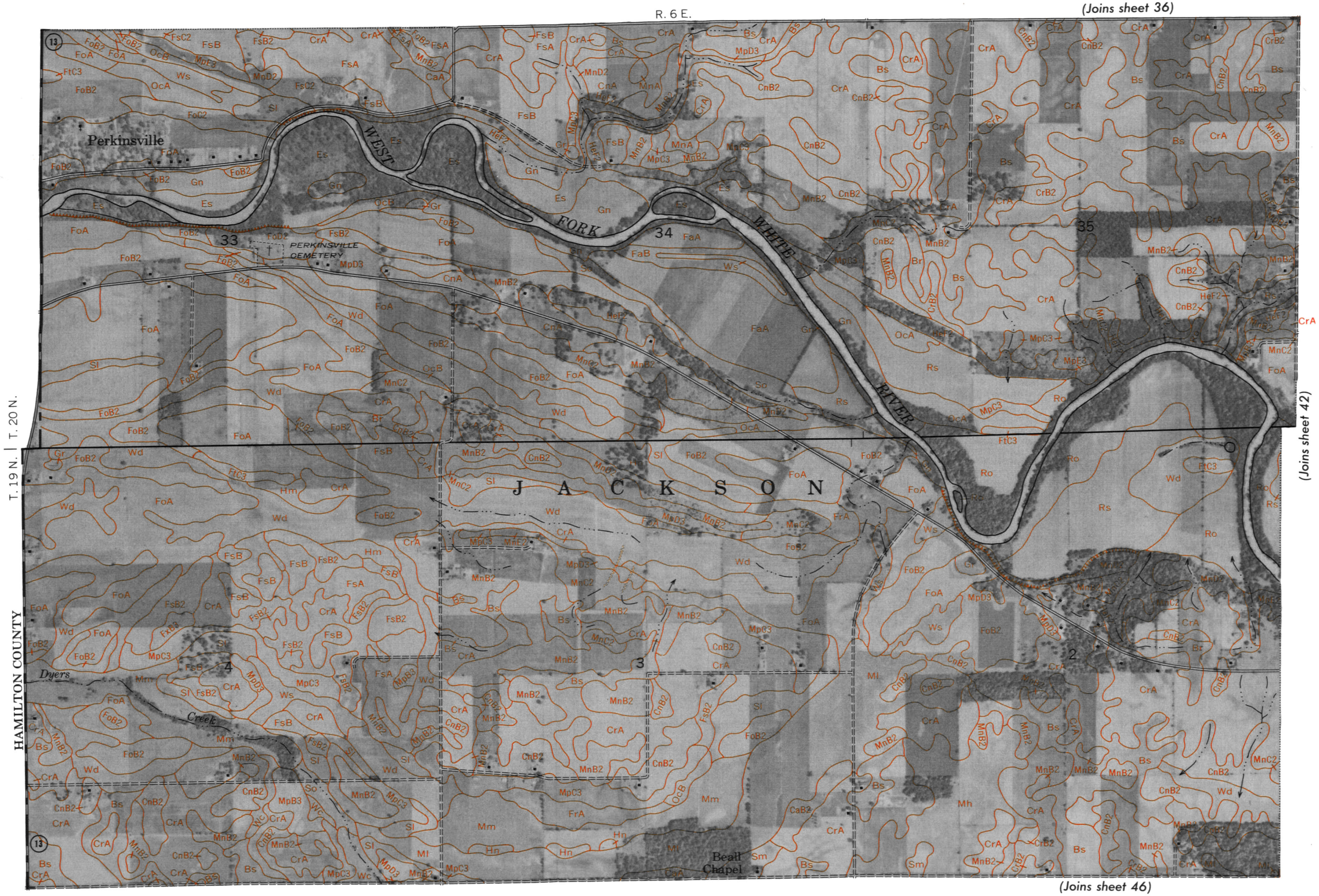
N



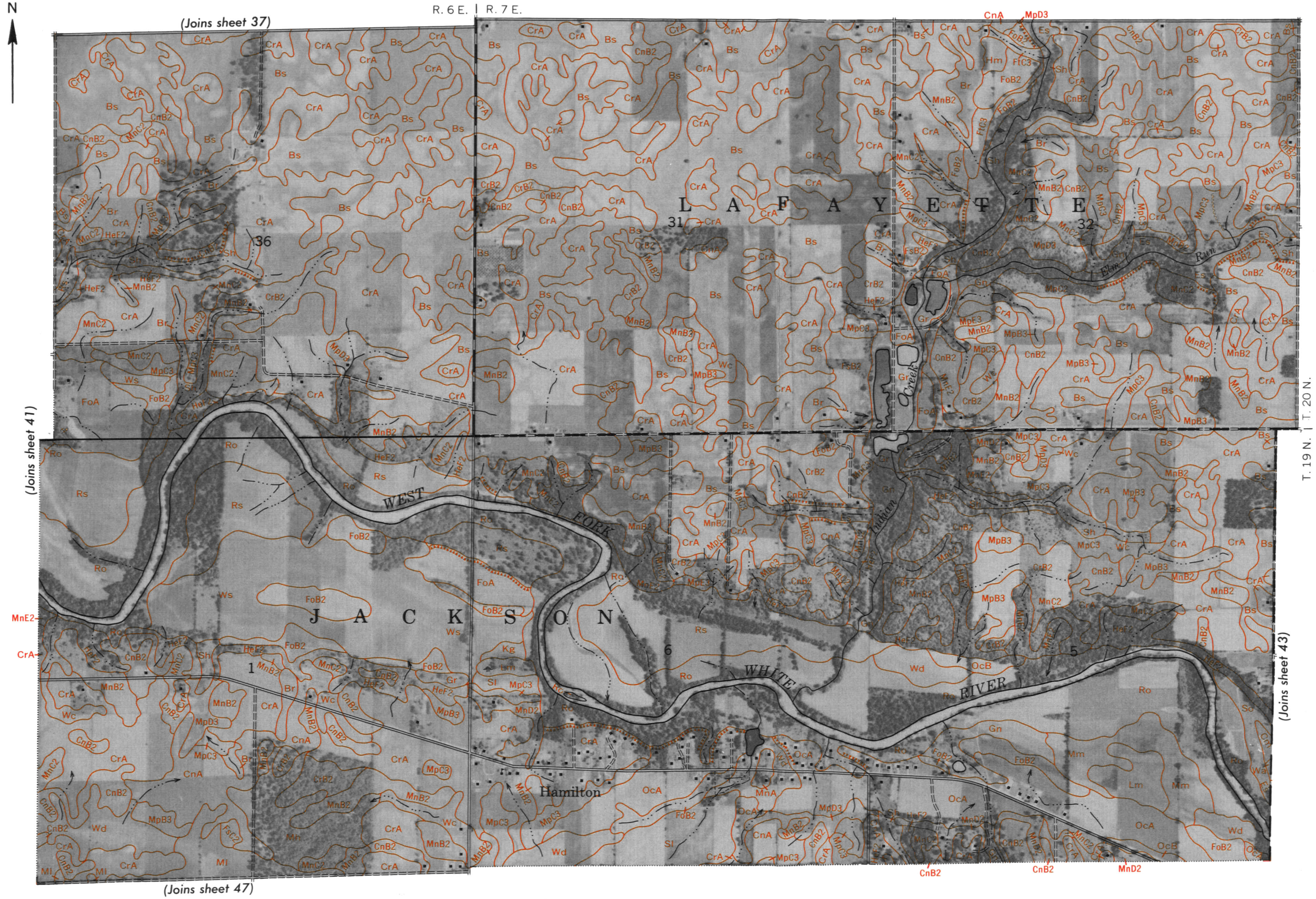
0 ½ Mile Scale 1:15840 0 3000 Feet

This map is one of a set compiled in 1966 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Purdue University Agricultural Experiment Station.

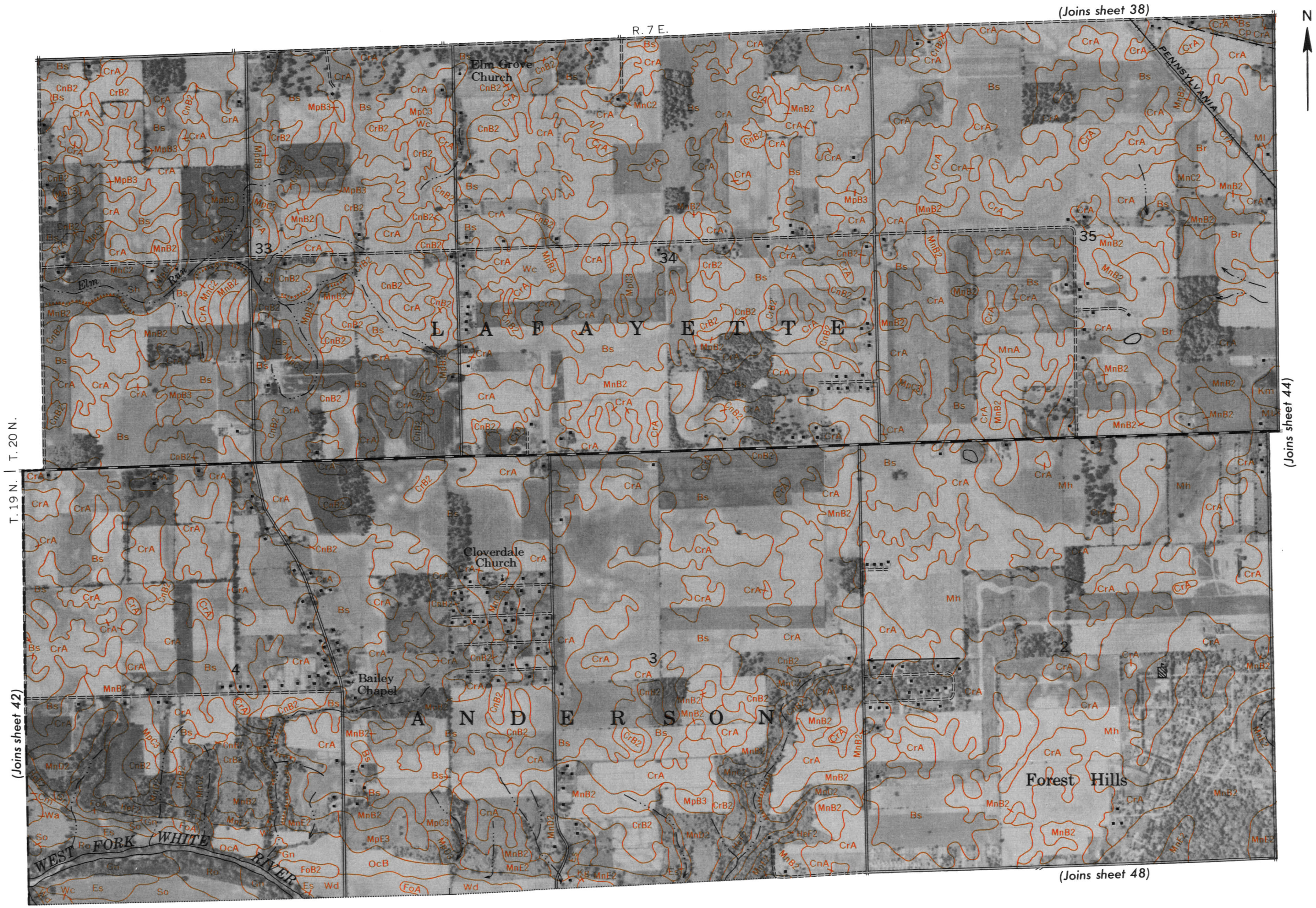
Range, township, and section corners shown on this map are indefinite.



0 ½ Mile Scale 1:15840 0 3000 Feet



0 ½ Mile Scale 1:15840 0 3000 Feet

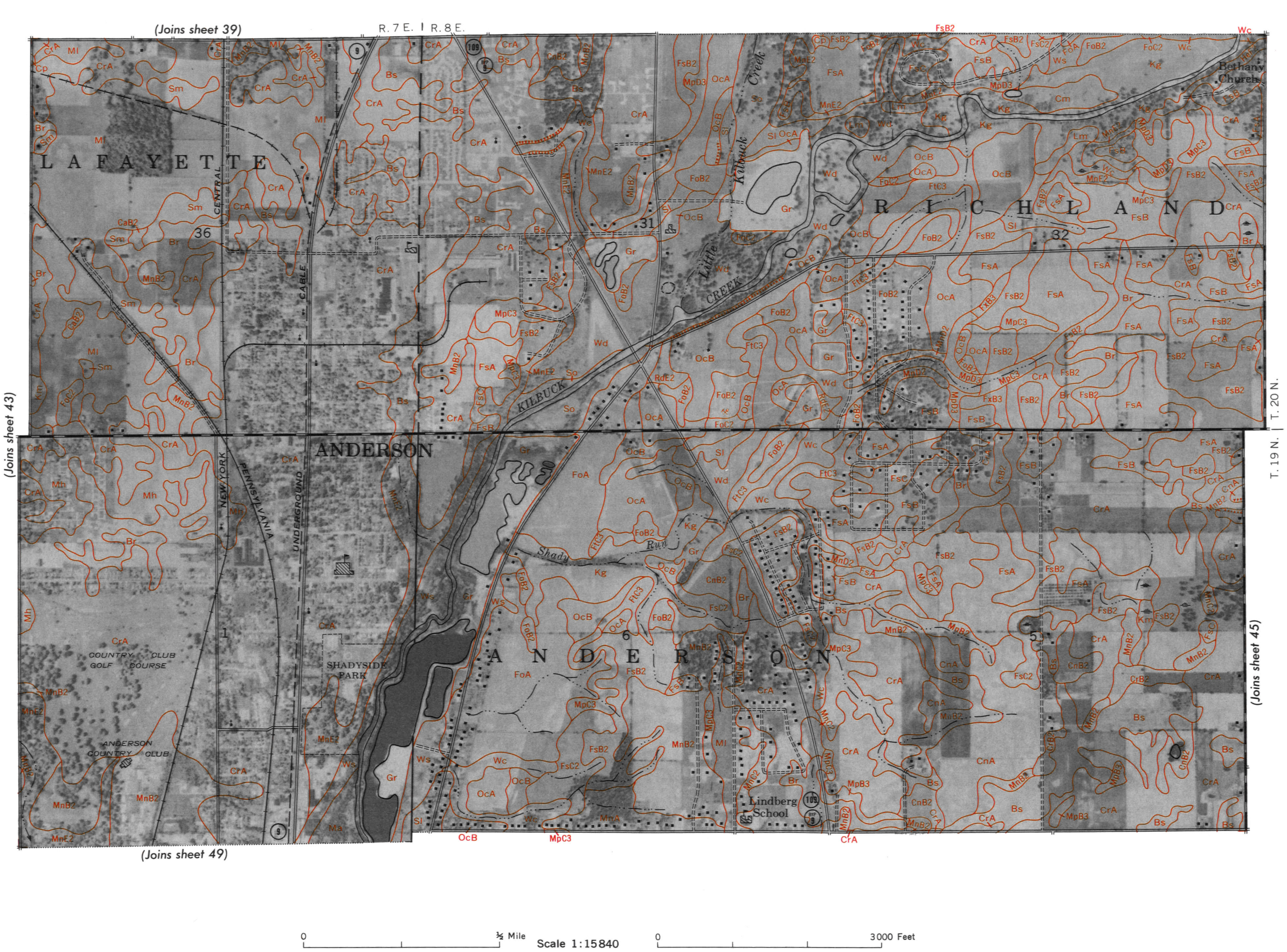


0 ½ Mile Scale 1:15840 0 3000 Feet

This map is one of a set compiled in 1966 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Purdue University Agricultural Experiment Station.

Range, township, and section corners shown on this map are indefinite.

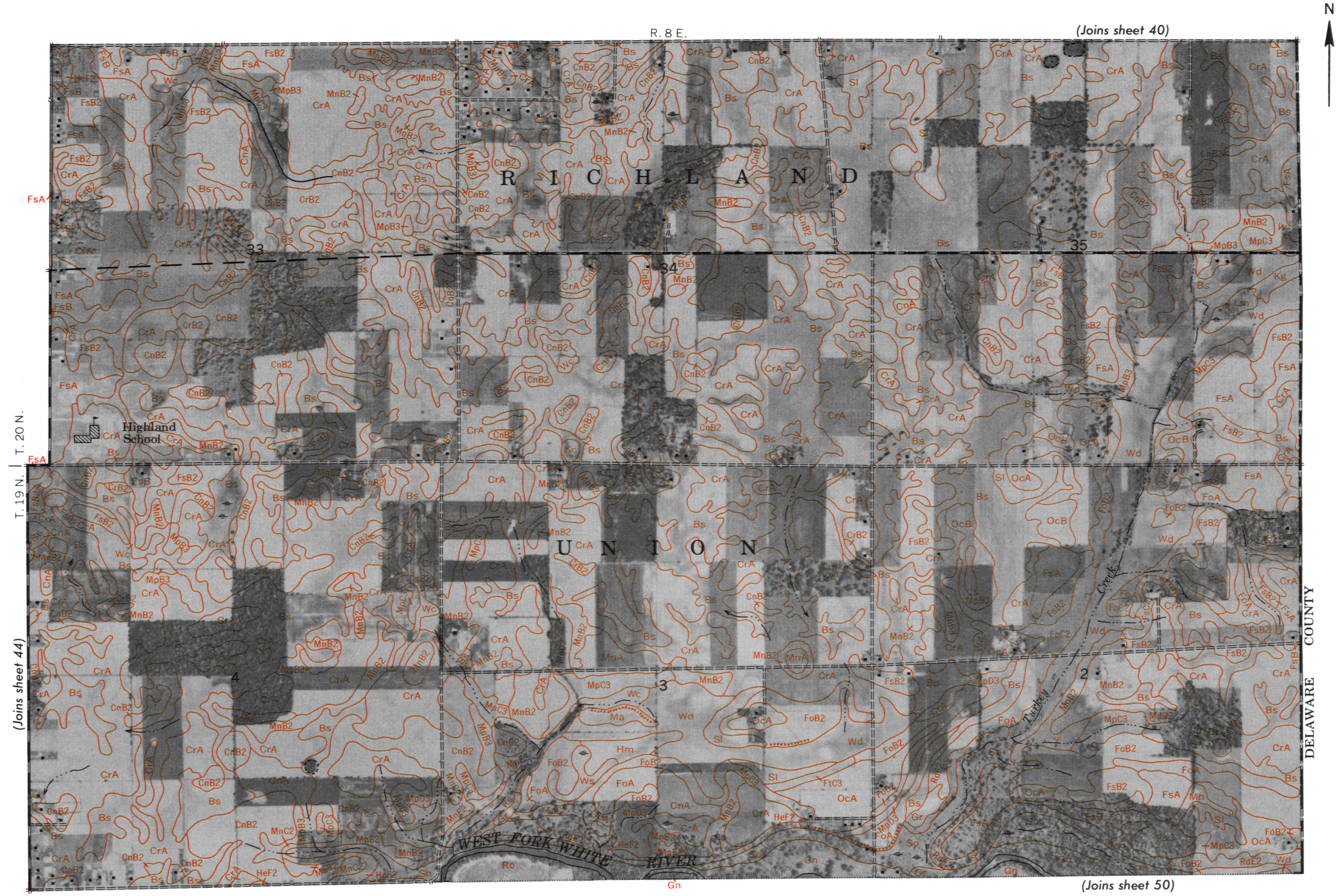
44



N
(Joins sheet 39)
R. 7 E.
R. 8 E.
(Joins sheet 43)
(Joins sheet 45)
(Joins sheet 49)
T. 20 N.
T. 19 N.
LAFAYETTE
RICHLAND
ANDERSON
ANDERSON
Bethany Church
Little Creek
Kilbuck Creek
KILBUCK
Shady Run
CENTRAL
CABLE
NEW YORK
PENNSYLVANIA
UNDERGROUND
SHADYSIDE PARK
COUNTRY CLUB GOLF COURSE
ANDERSON COUNTRY CLUB
Lindberg School
36
31
32
1
6
5
0
½ Mile
Scale 1:15840
0
3000 Feet

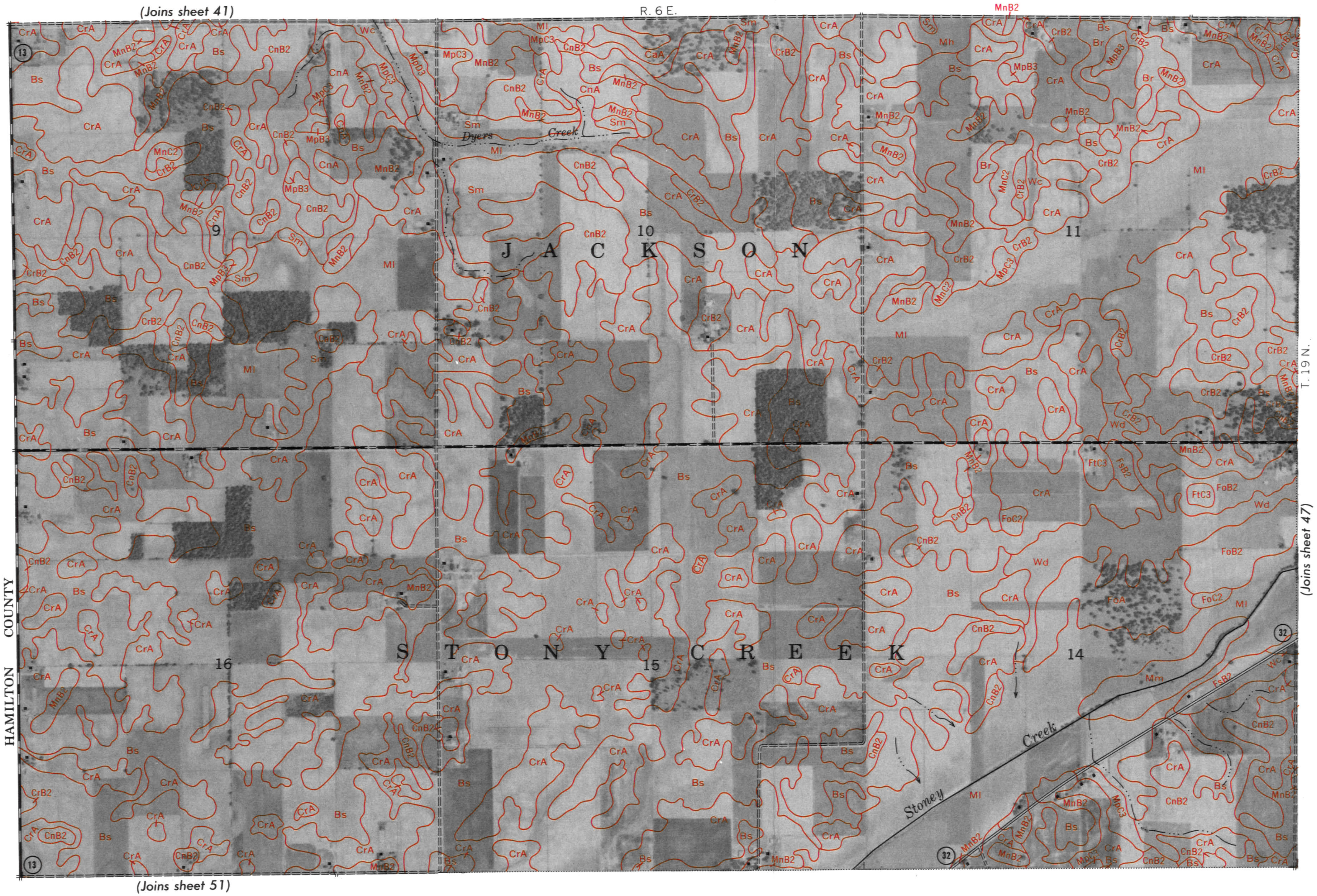
This map is one of a set compiled in 1966 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Purdue University Agricultural Experiment Station.

Range, township, and section corners shown on this map are indefinite.



0 ½ Mile Scale 1:15840 0 3000 Feet

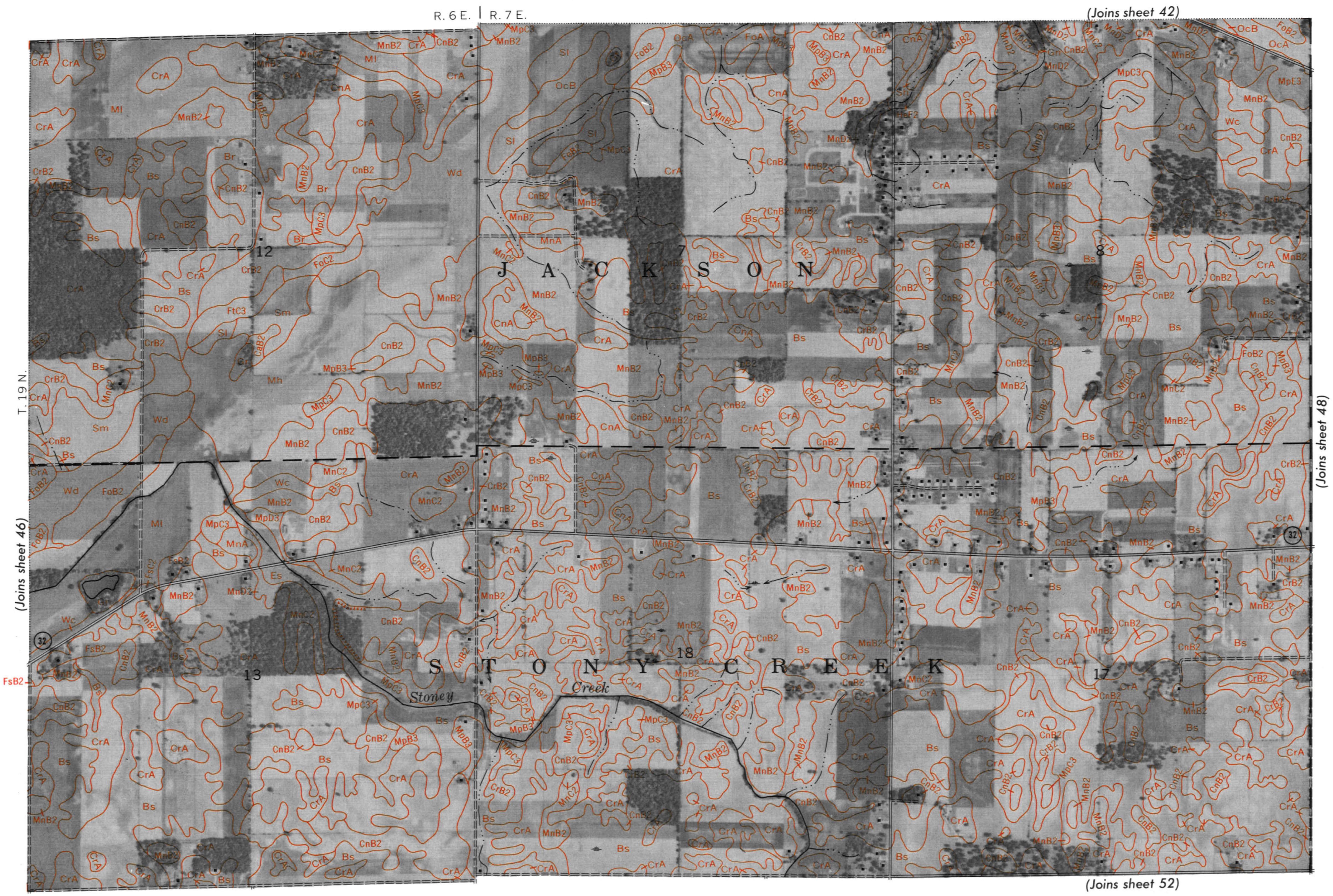
N



0 ½ Mile Scale 1:15840 0 3000 Feet

This map is one of a set compiled in 1966 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Purdue University Agricultural Experiment Station.

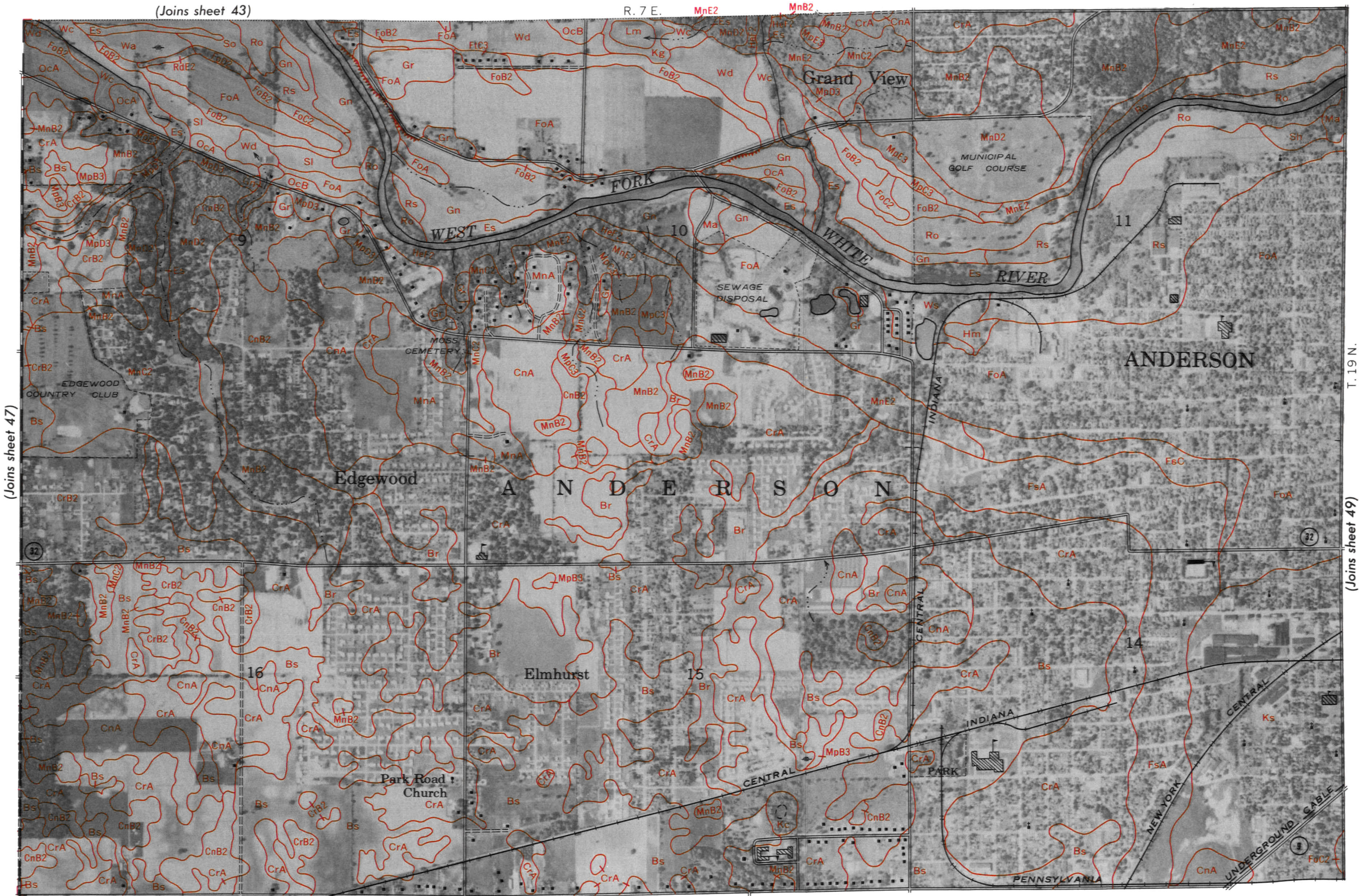
Range, township, and section corners shown on this map are indefinite.



0 ½ Mile Scale 1:15840 0 3000 Feet

N

(Joins sheet 43)



(Joins sheet 47)

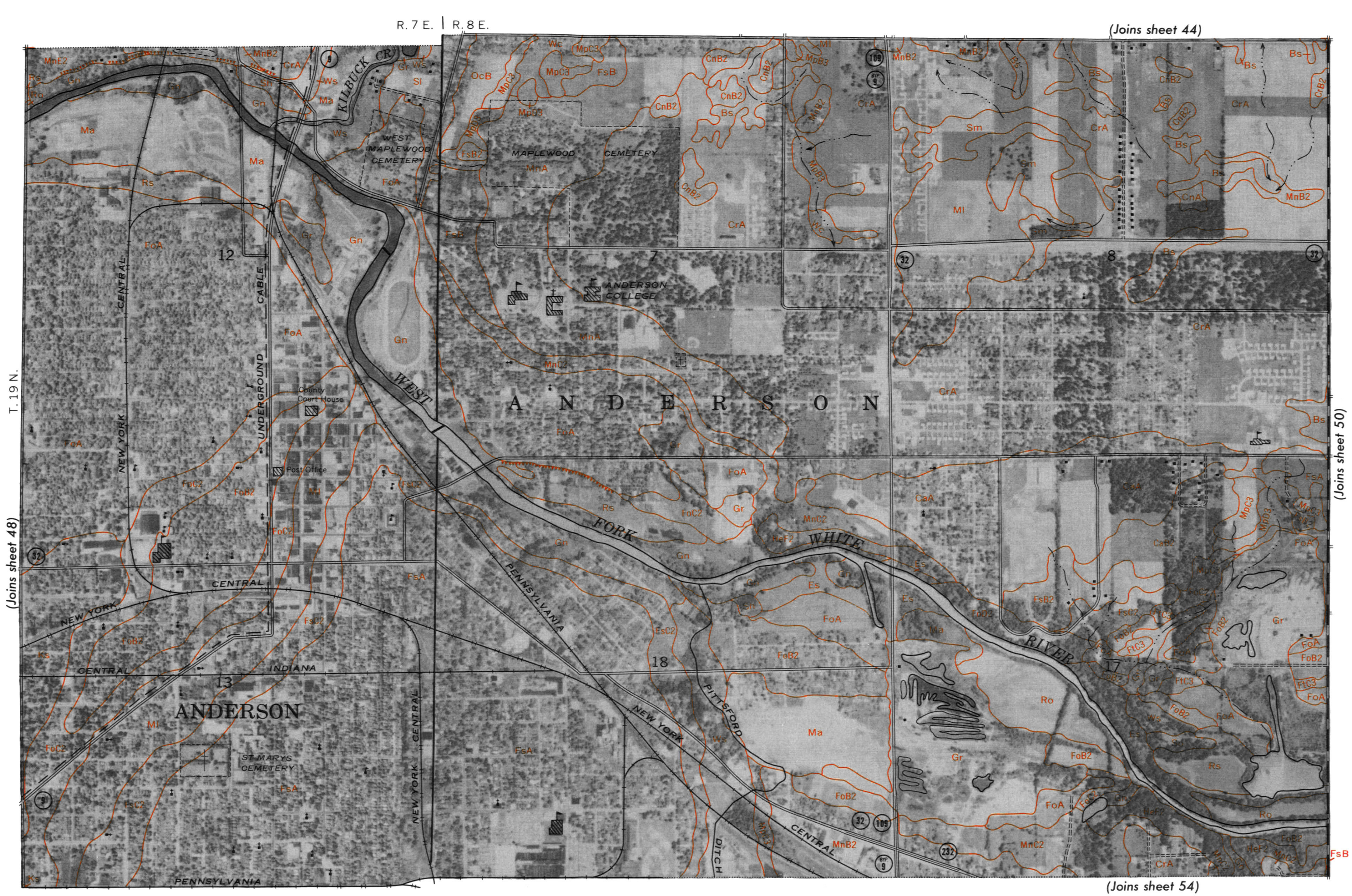
(Joins sheet 49)

(Joins sheet 53)

0 ½ Mile Scale 1:15840 0 3000 Feet

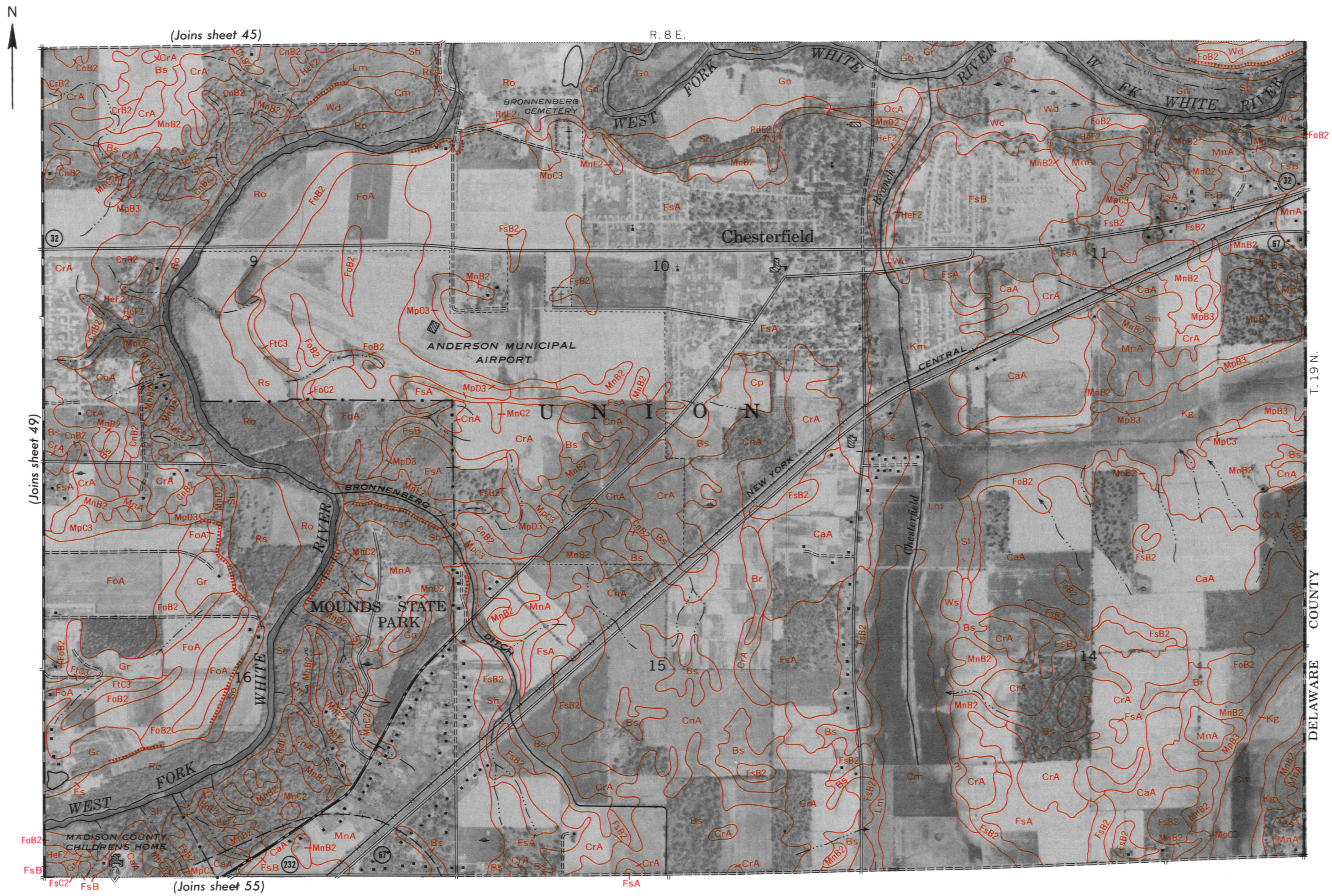
This map is one of a set compiled in 1966 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Purdue University Agricultural Experiment Station.

Range, township, and section corners shown on this map are indefinite.



0 ½ Mile Scale 1:15840 0 3000 Feet

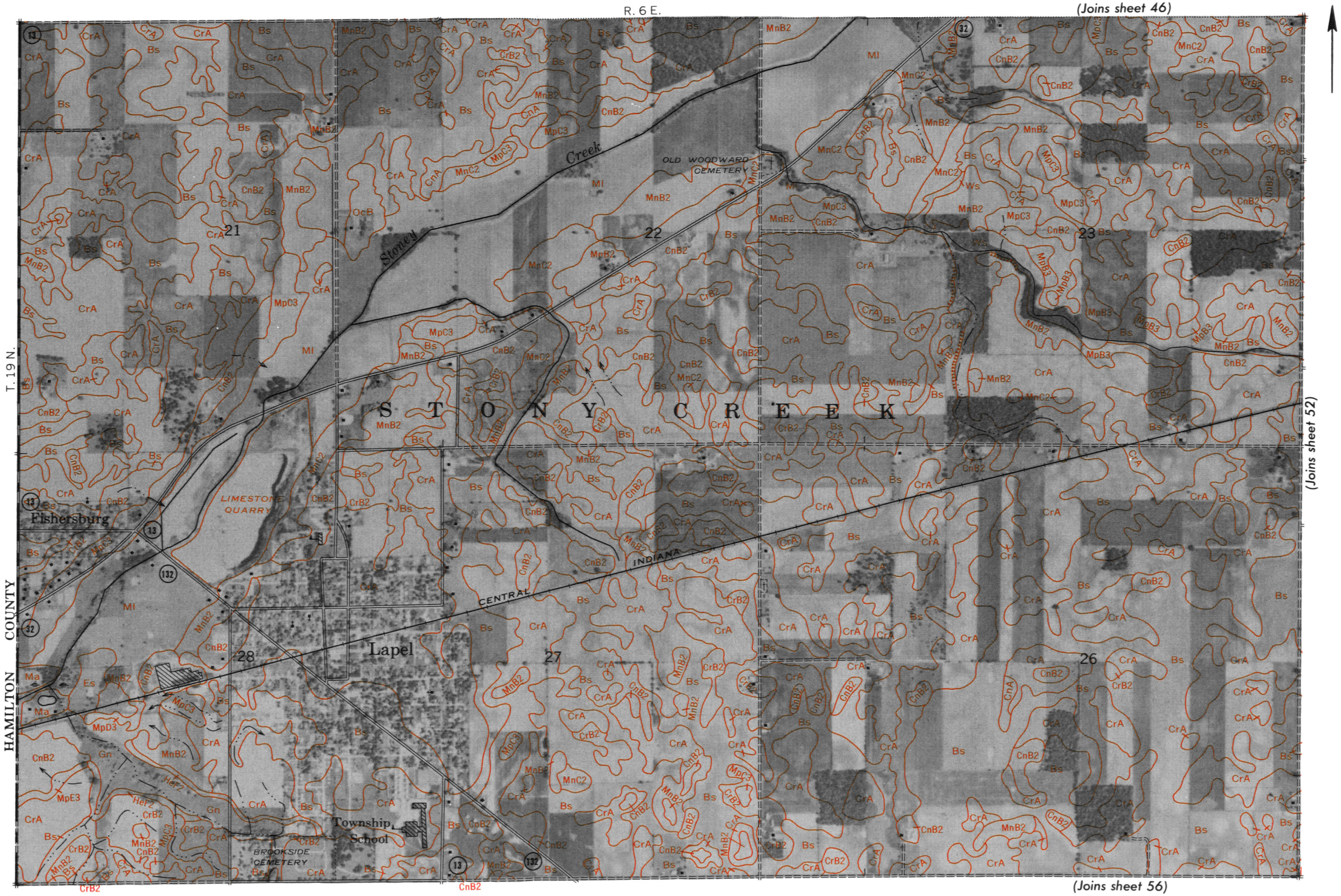
MADISON COUNTY, INDIANA — SHEET NUMBER 50



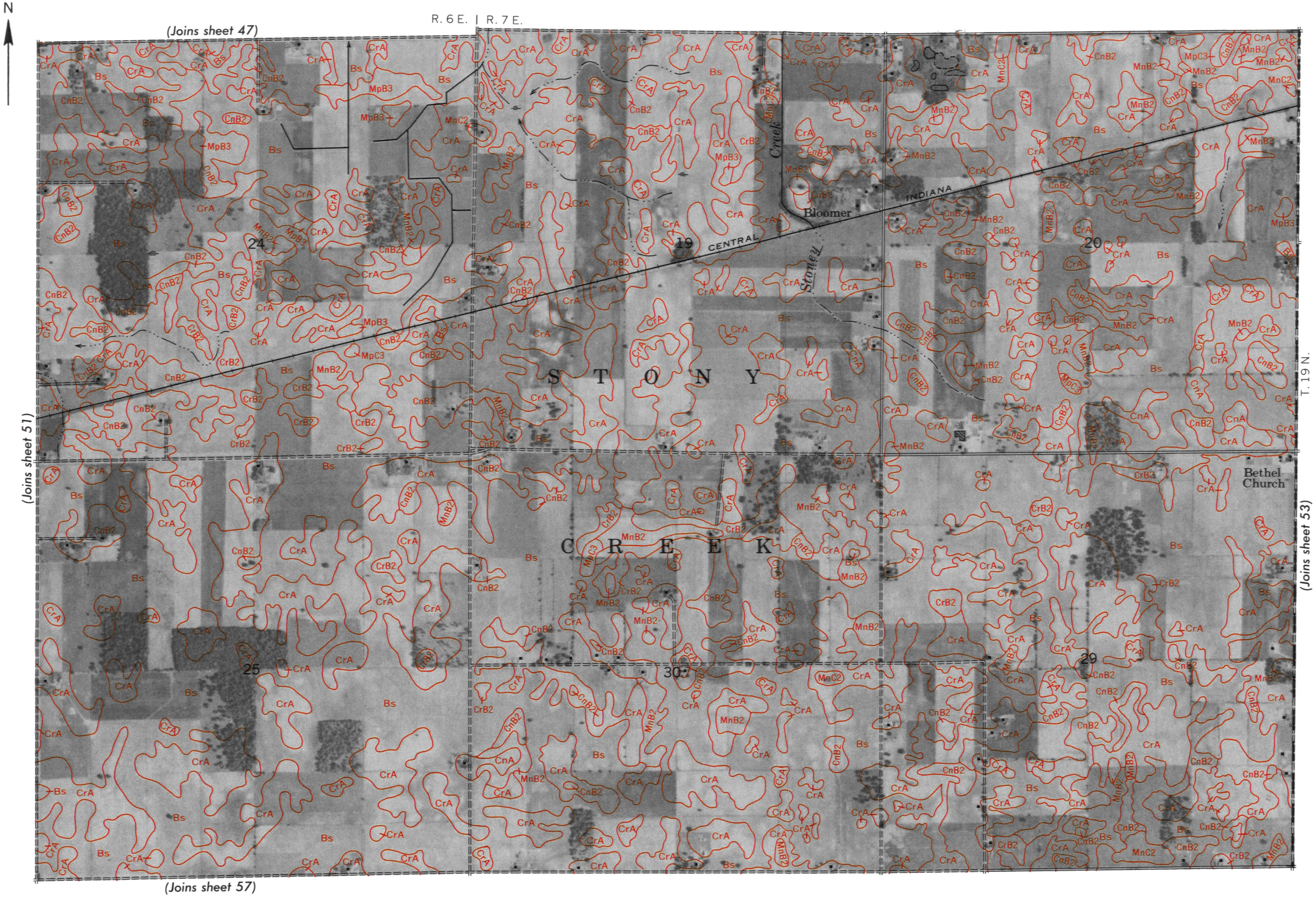
0 ½ Mile Scale 1:15840 0 3000 Feet

This map is one of a set compiled in 1966 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Purdue University Agricultural Experiment Station.

Range, township, and section corners shown on this map are indefinite.



0 ½ Mile Scale 1:15840 0 3000 Feet



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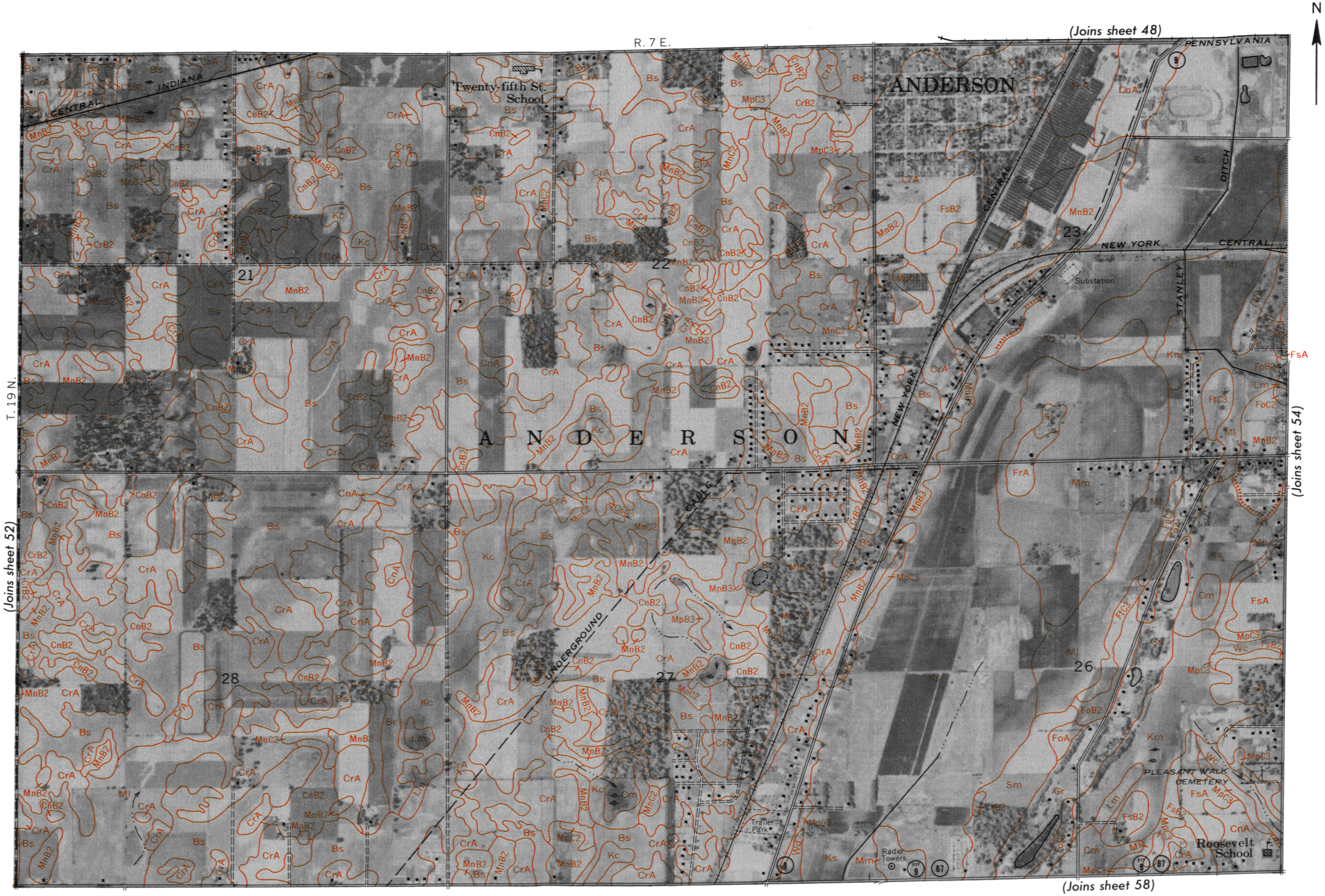
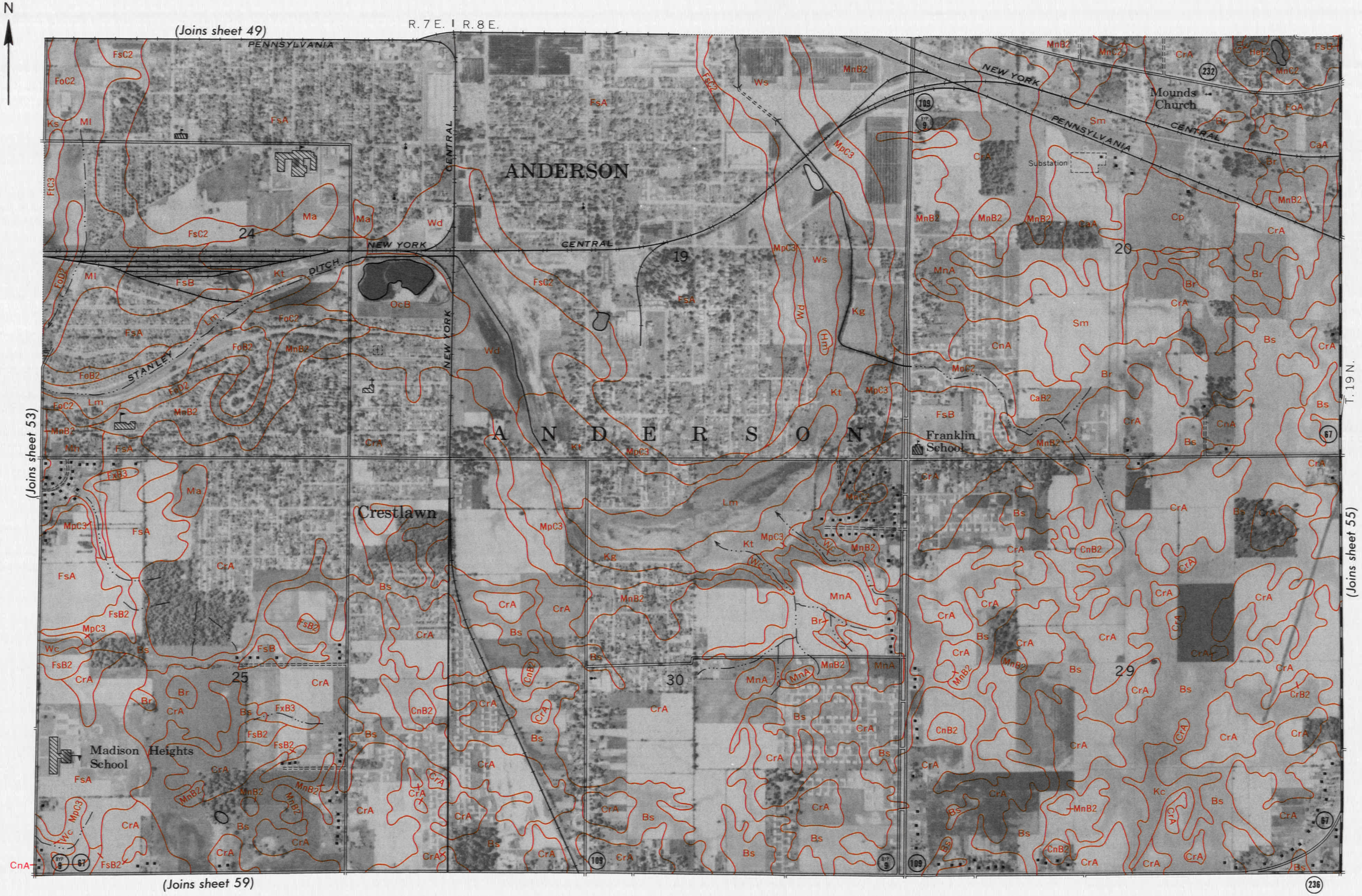
MADISON COUNTY, INDIANA — SHEET NUMBER 53



This map is one of a set compiled in 1966 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Purdue University Agricultural Experiment Station.

Range, township, and section corners shown on this map are indefinite.

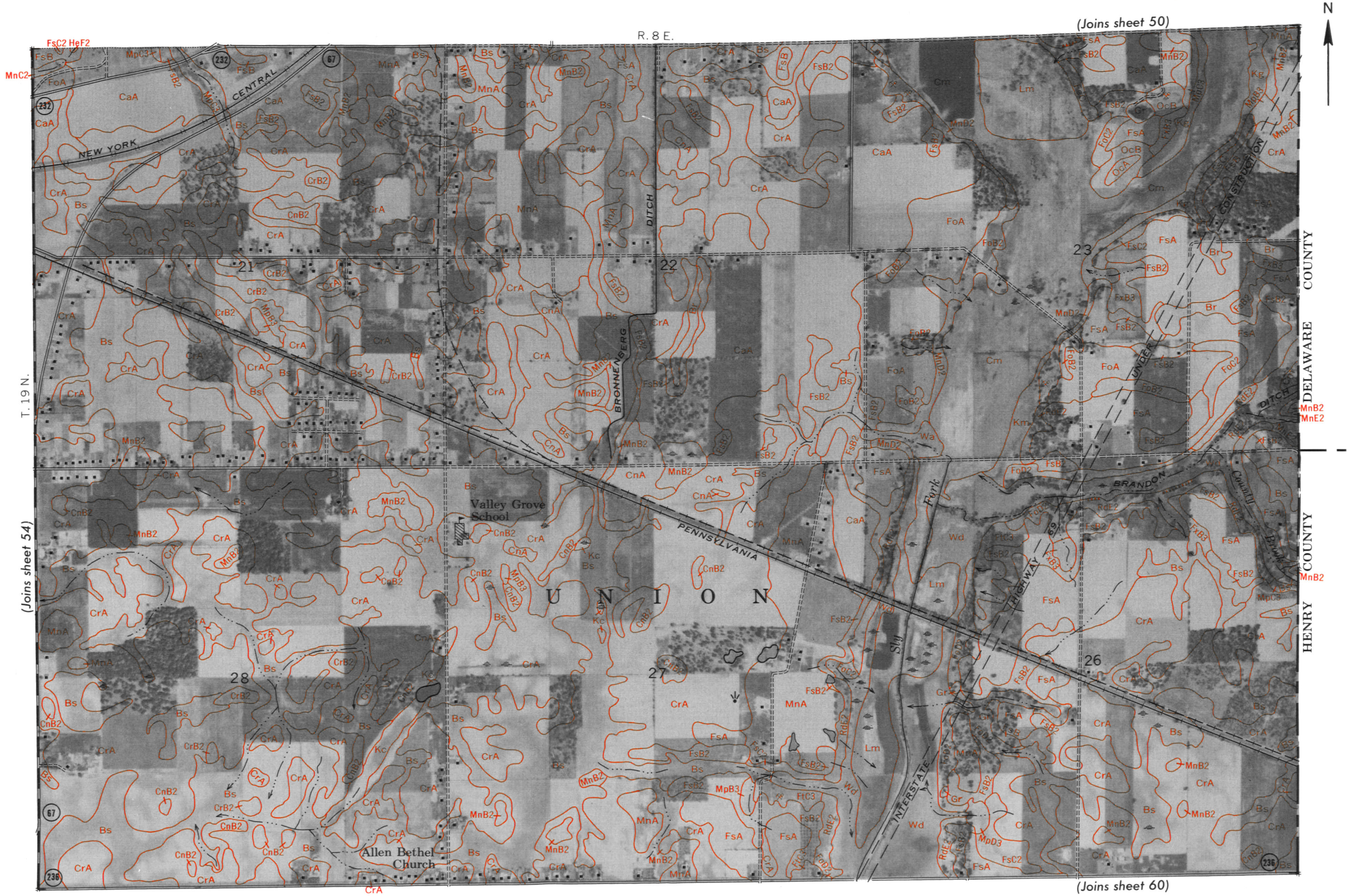
0 ½ Mile Scale 1:15840 0 3000 Feet



0 ½ Mile Scale 1:15840 0 3000 Feet

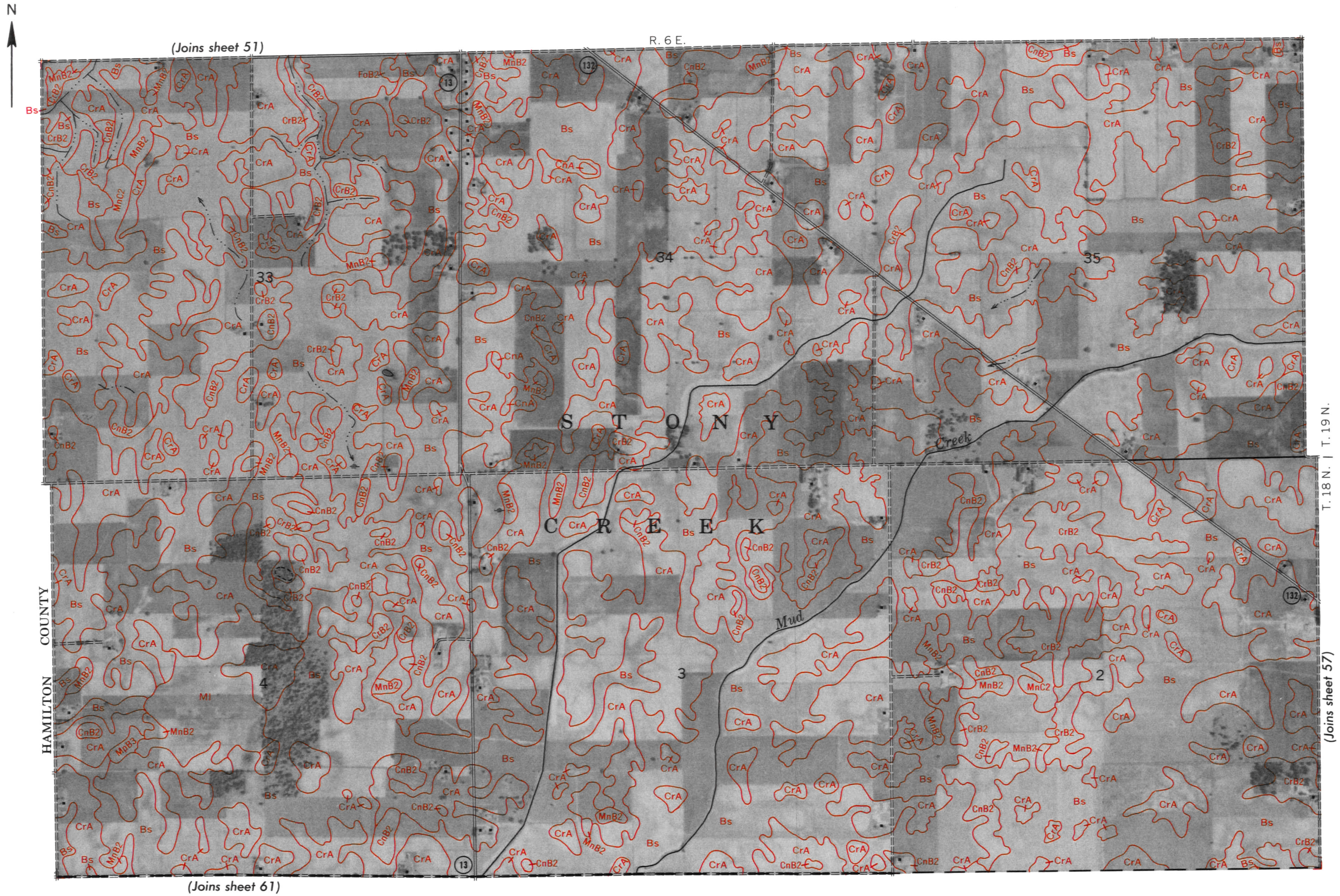
This map is one of a set compiled in 1966 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Purdue University Agricultural Experiment Station.

Range, township, and section corners shown on this map are indefinite.



0 ½ Mile Scale 1:15840 0 3000 Feet

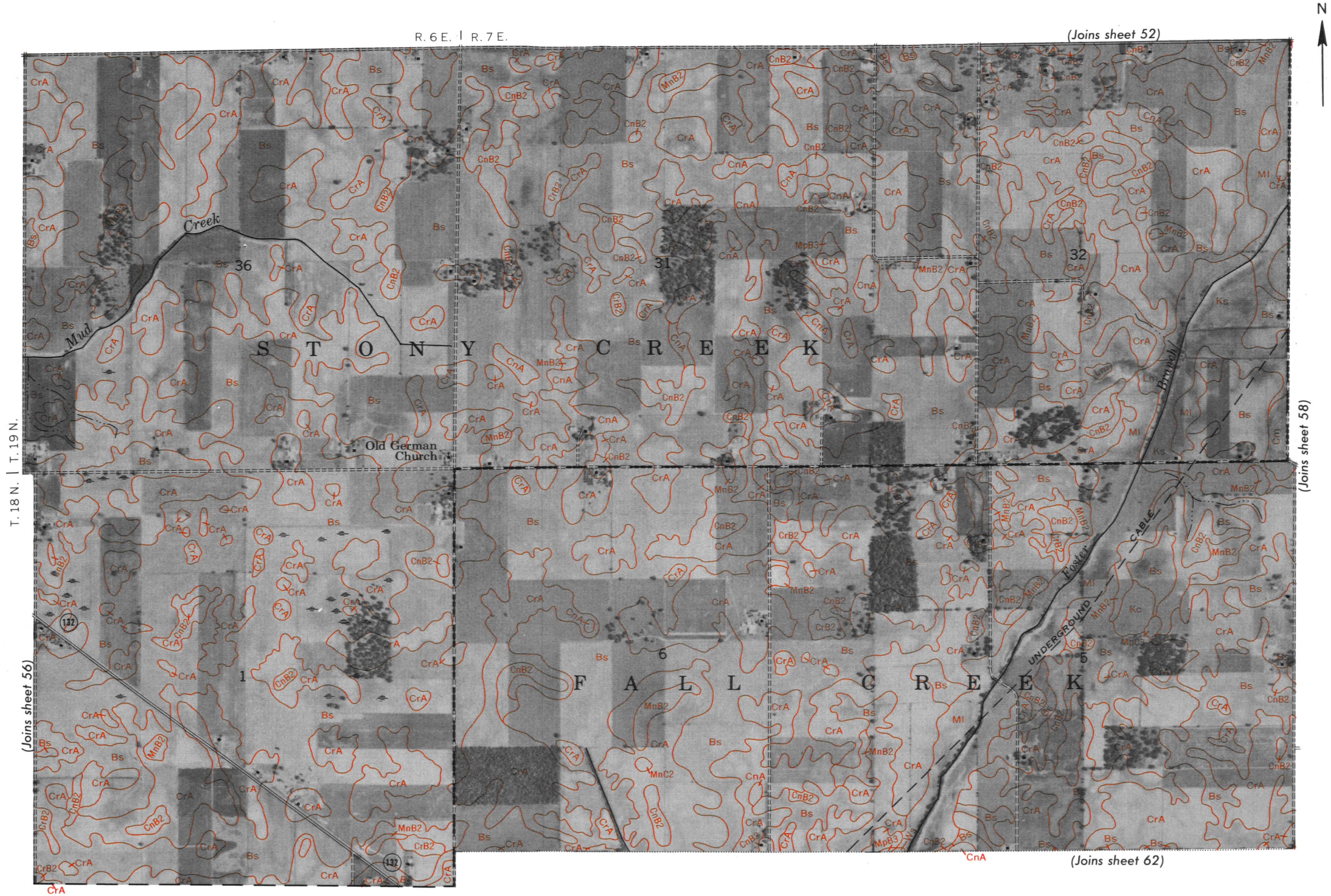
MADISON COUNTY, INDIANA — SHEET NUMBER 56



0 ½ Mile Scale 1:15840 0 3000 Feet

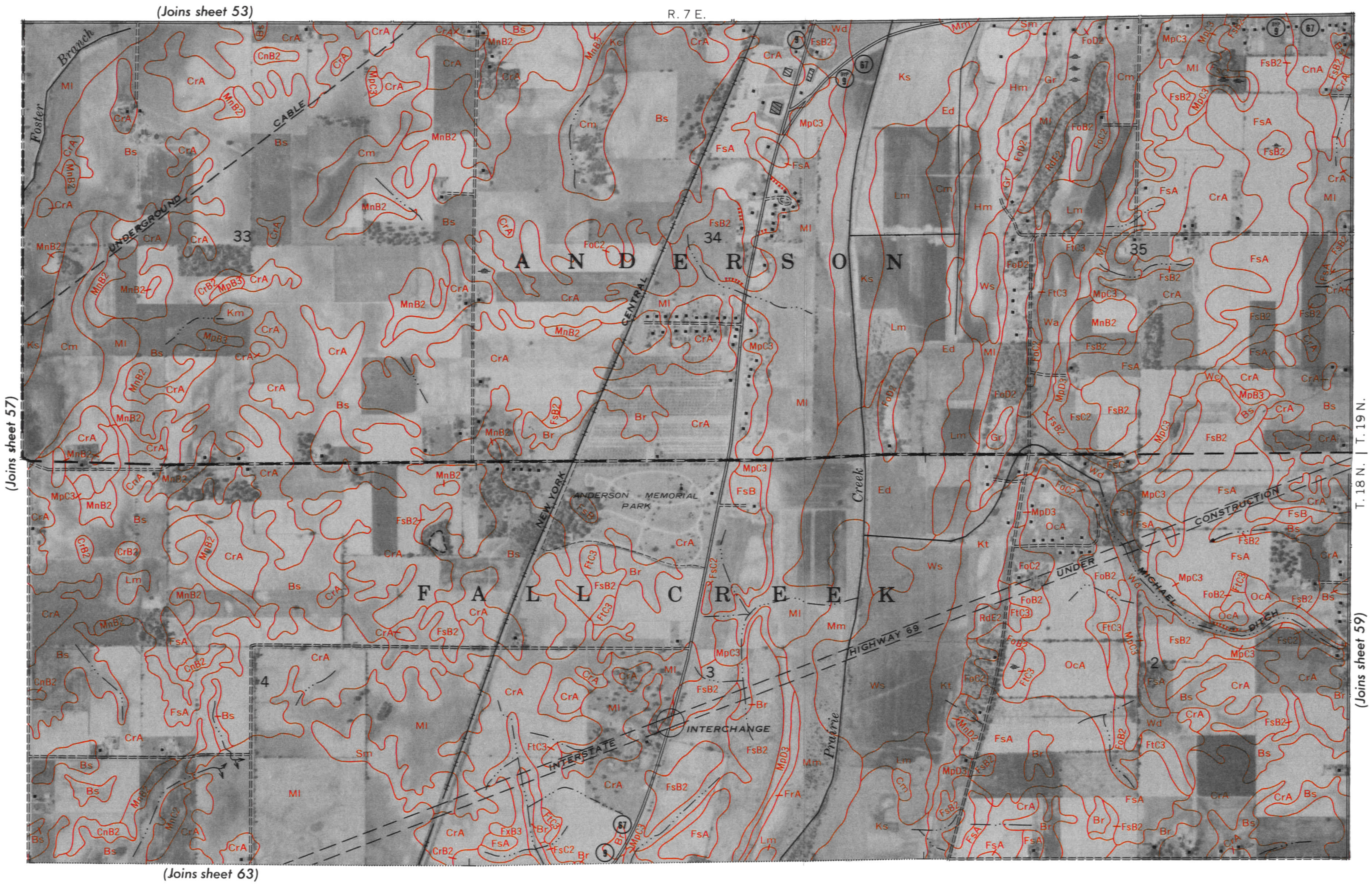
This map is one of a set compiled in 1966 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Purdue University Agricultural Experiment Station.

Range, township, and section corners shown on this map are indefinite.



0 ½ Mile Scale 1:15840 0 3000 Feet

N

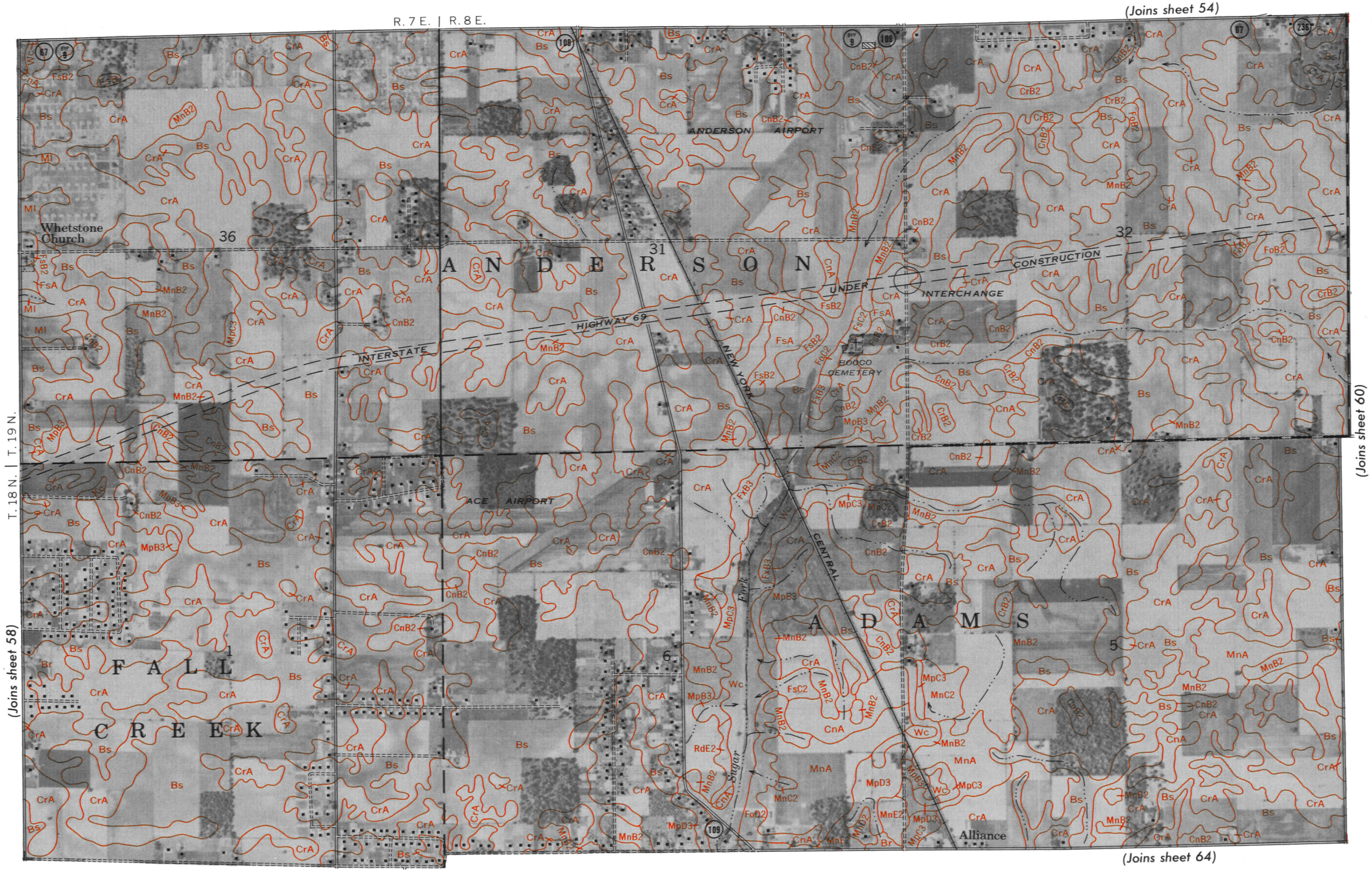


0 ½ Mile

Scale 1:15840

0 3000 Feet

N



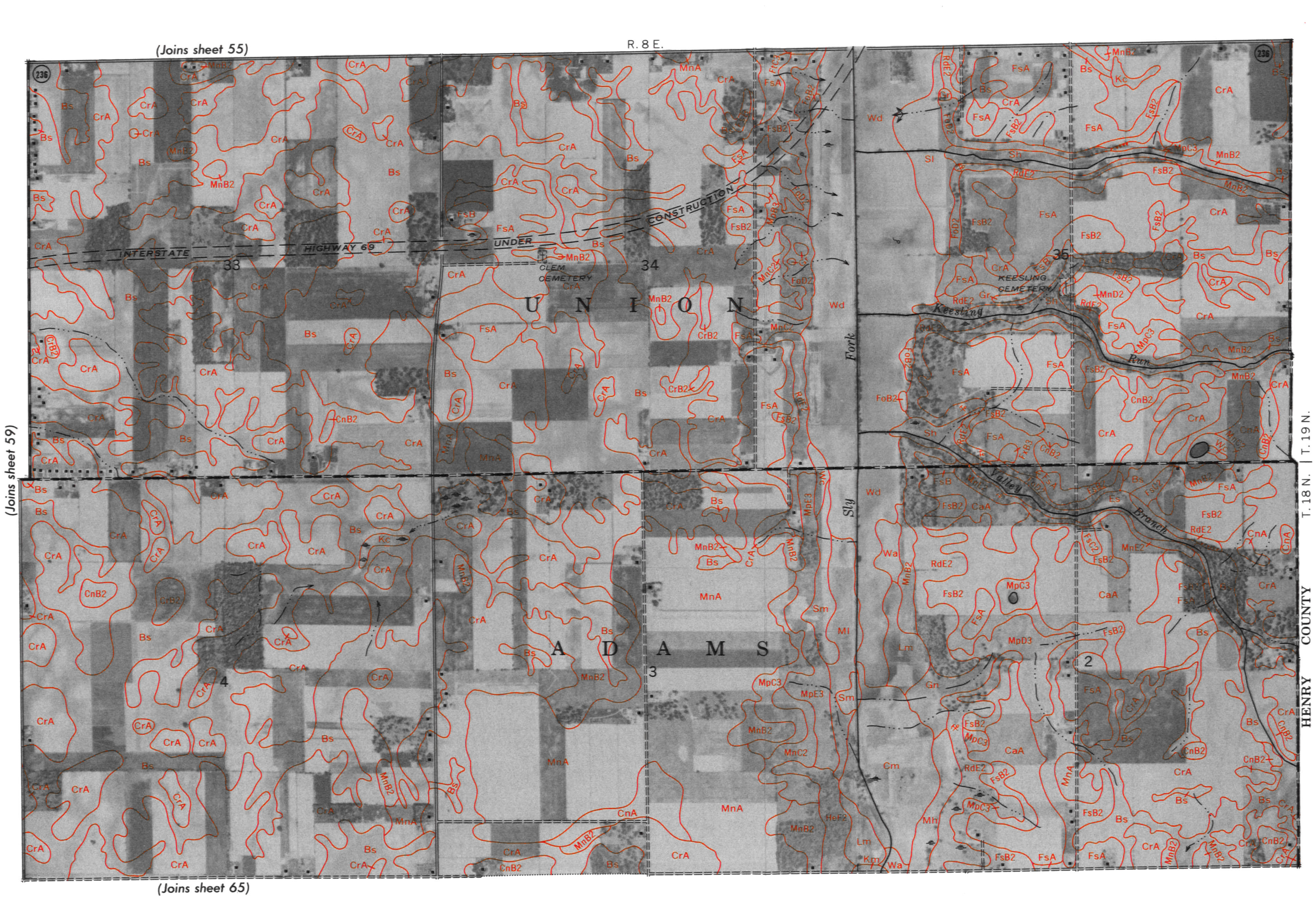
This map is one of a set compiled in 1966 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Purdue University Agricultural Experiment Station.

Range, township, and section corners shown on this map are indefinite.

0 ½ Mile

Scale 1:15840

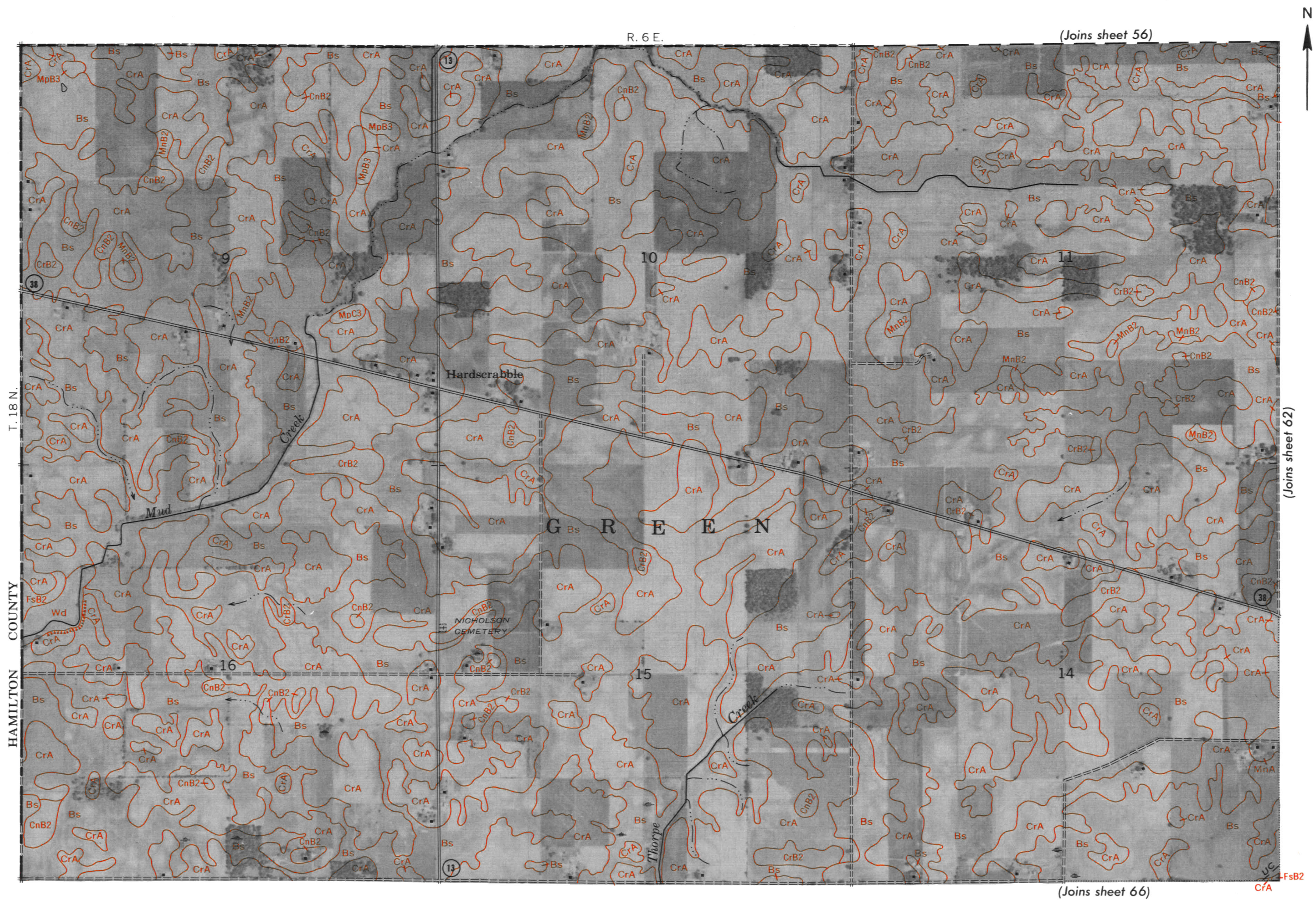
0 3000 Feet



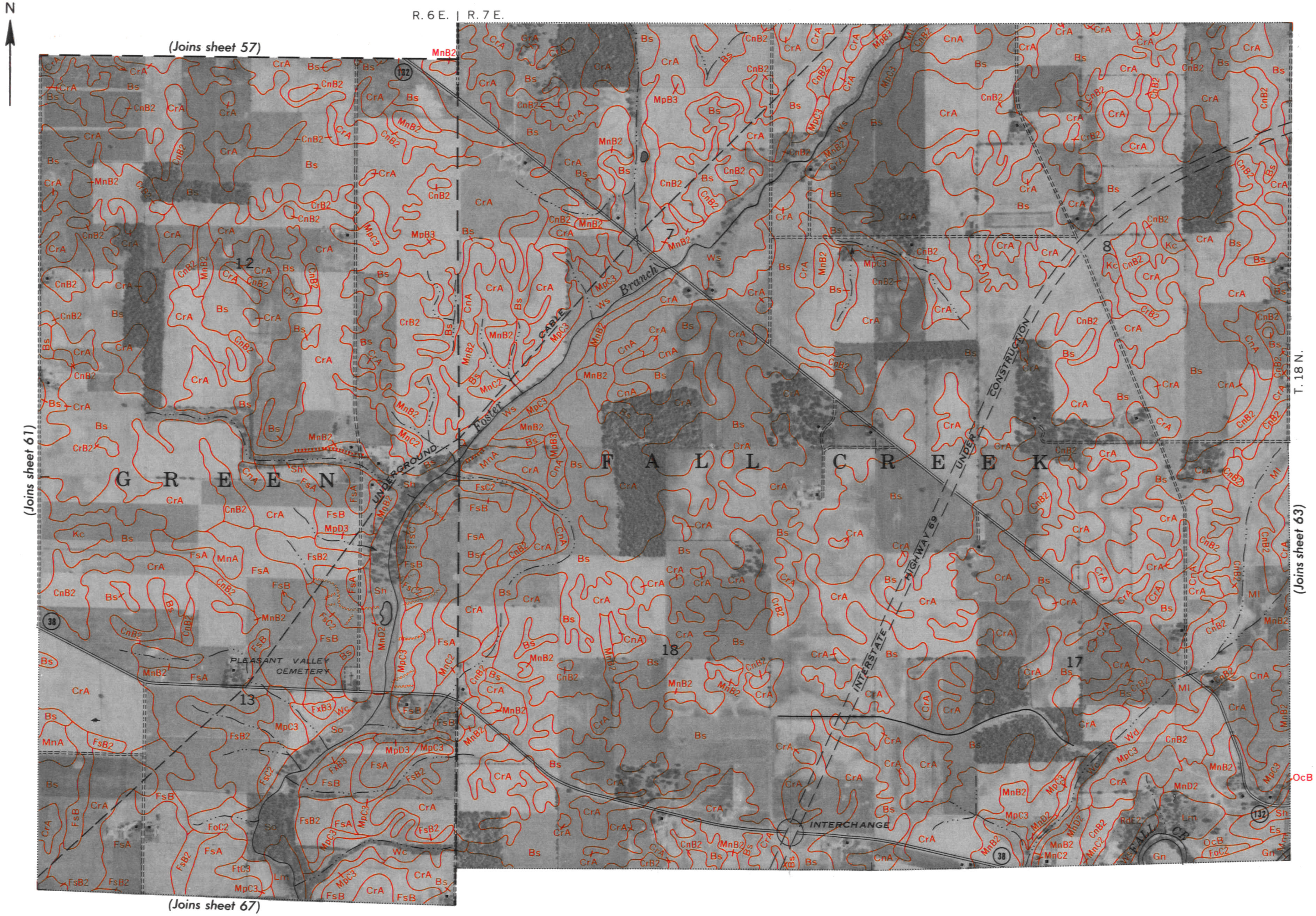
0 ½ Mile Scale 1:15840 0 3000 Feet

This map is one of a set compiled in 1966 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Purdue University Agricultural Experiment Station.

Range, township, and section corners shown on this map are indefinite.



0 ½ Mile Scale 1:15840 0 3000 Feet



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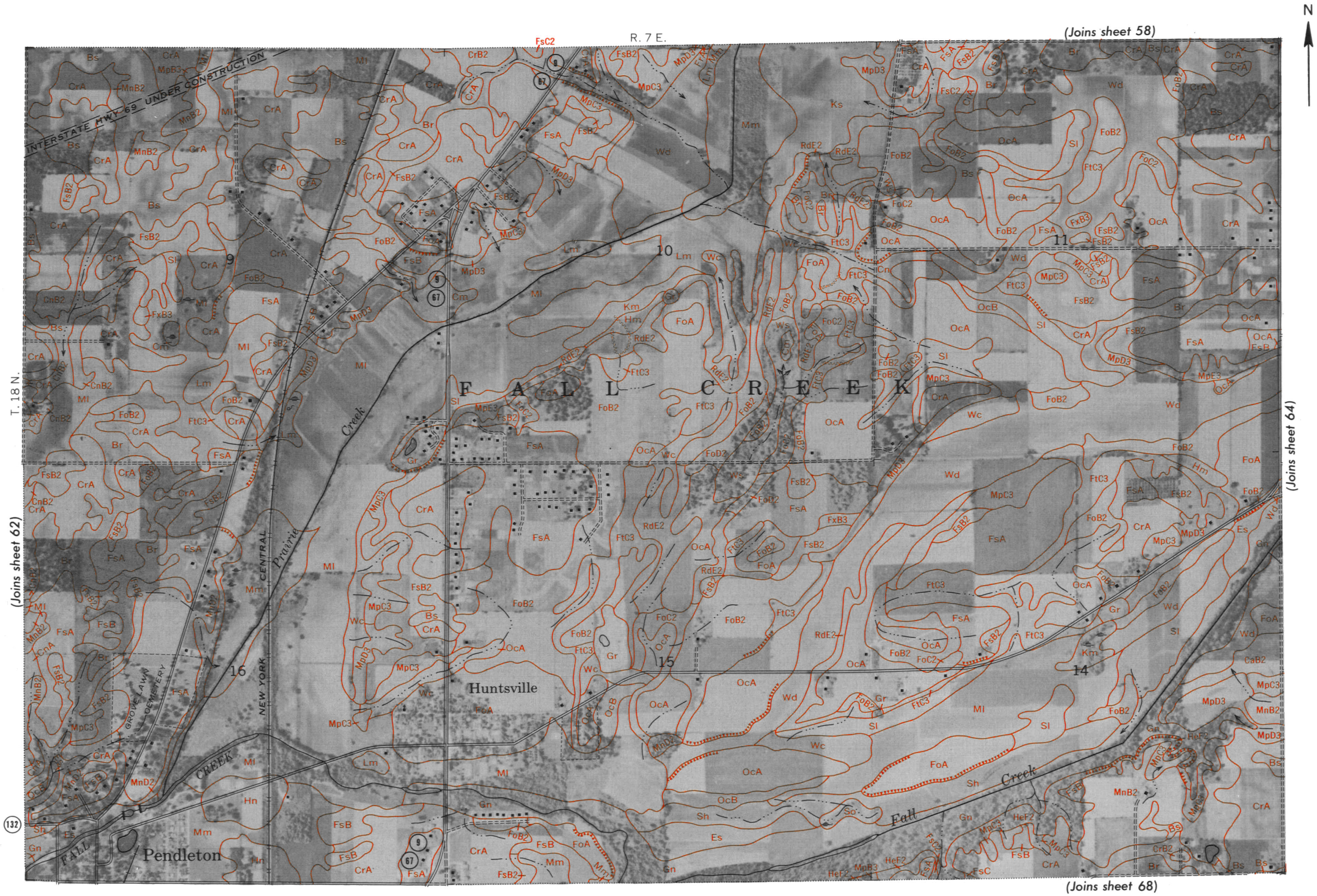
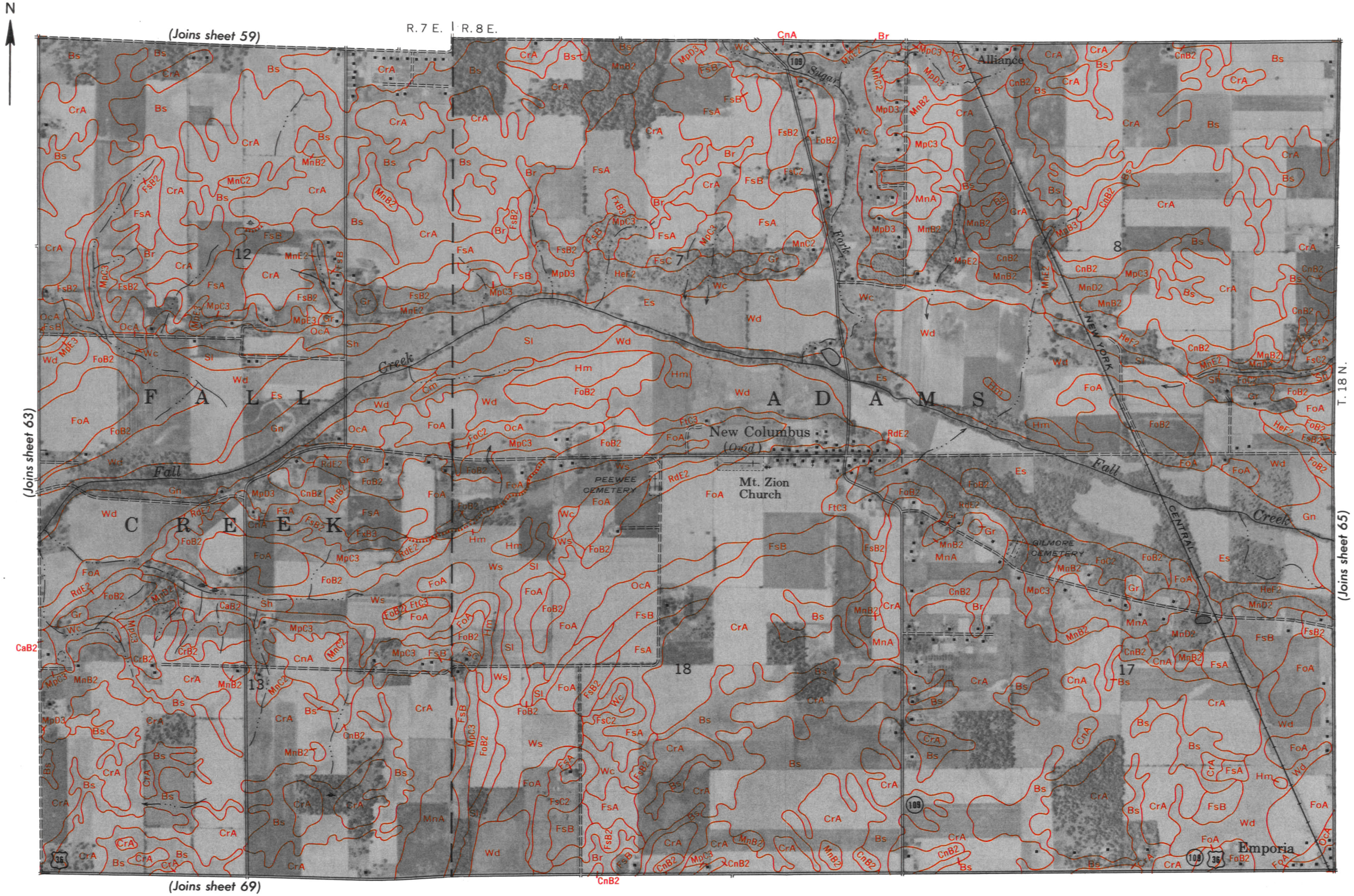


0 ½ Mile Scale 1:15840 0 3000 Feet

This map is one of a set compiled in 1966 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Purdue University Agricultural Experiment Station.

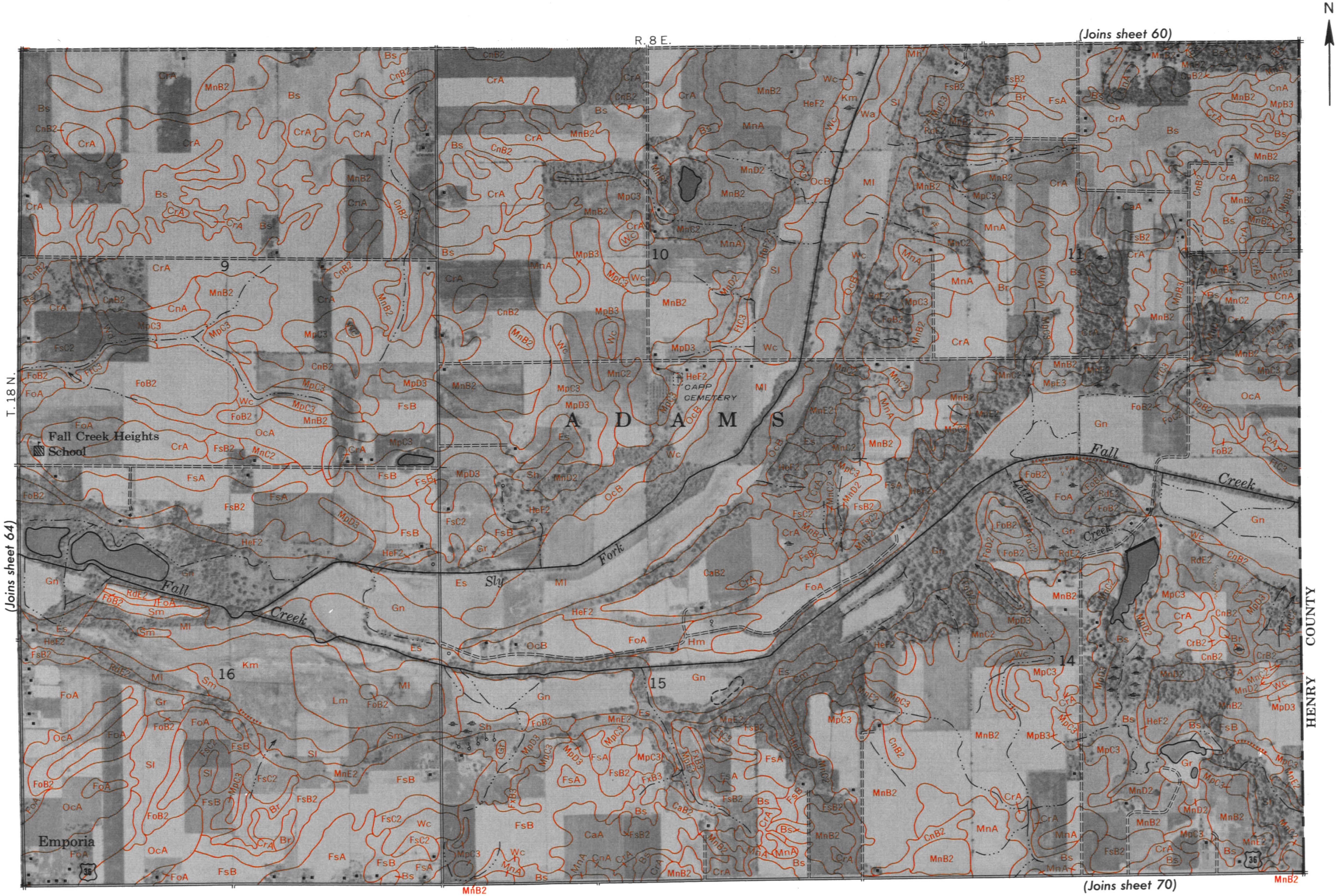
Range, township, and section corners shown on this map are indefinite.



0 ½ Mile Scale 1:15840 0 3000 Feet

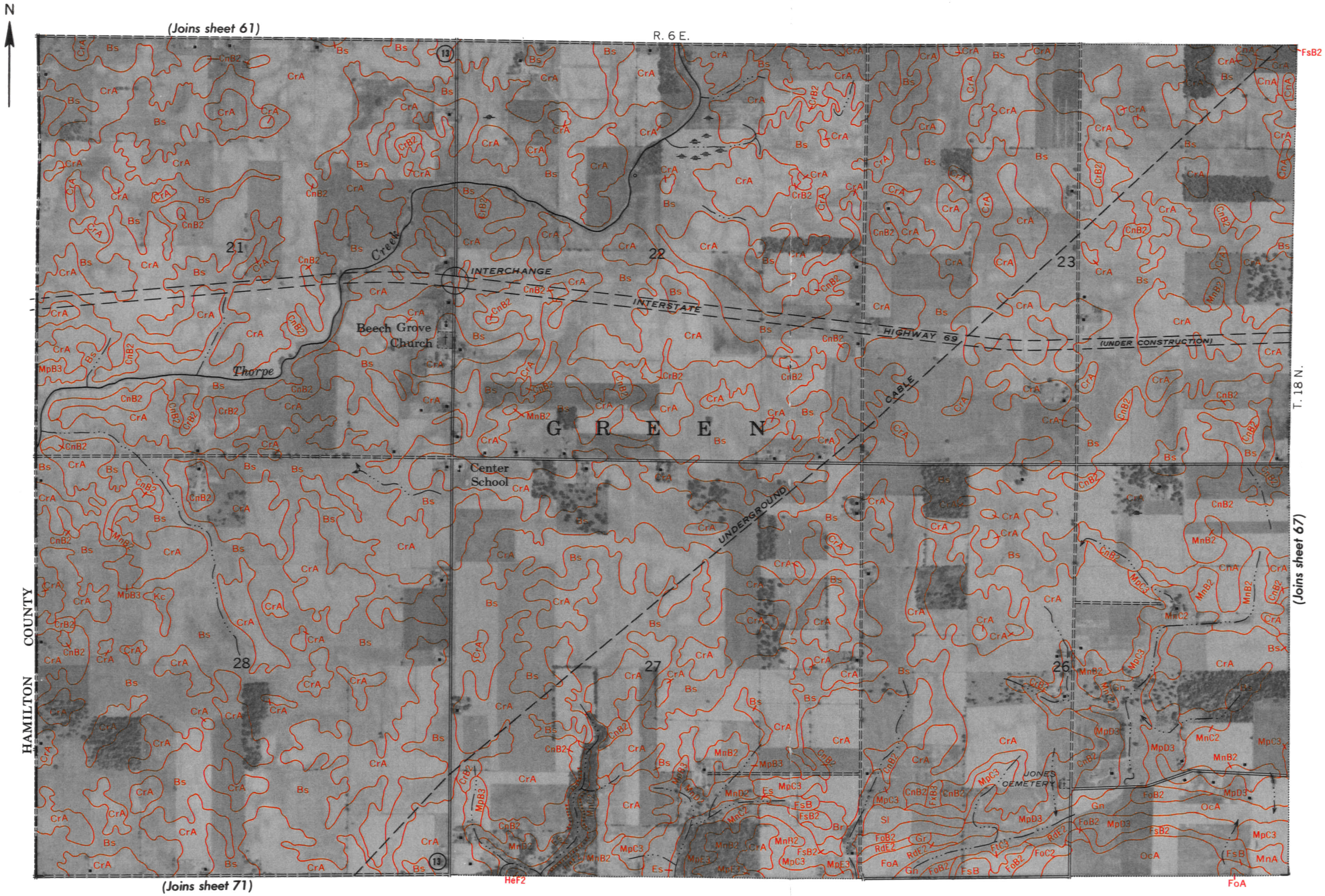
This map is one of a set compiled in 1966 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Purdue University Agricultural Experiment Station.

Range, township, and section corners shown on this map are indefinite.



0 ½ Mile Scale 1:15840 0 3000 Feet

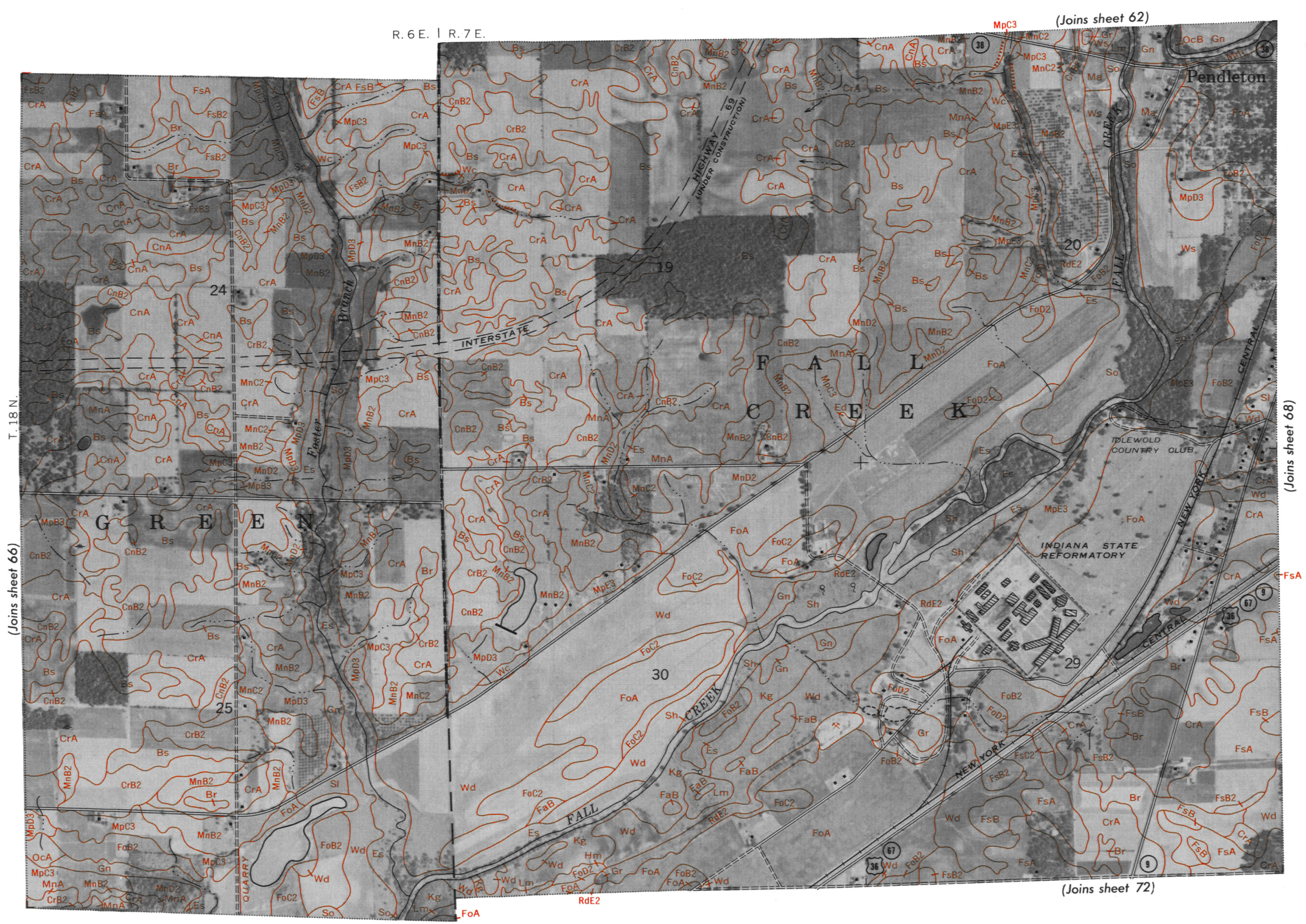
MADISON COUNTY, INDIANA — SHEET NUMBER 66



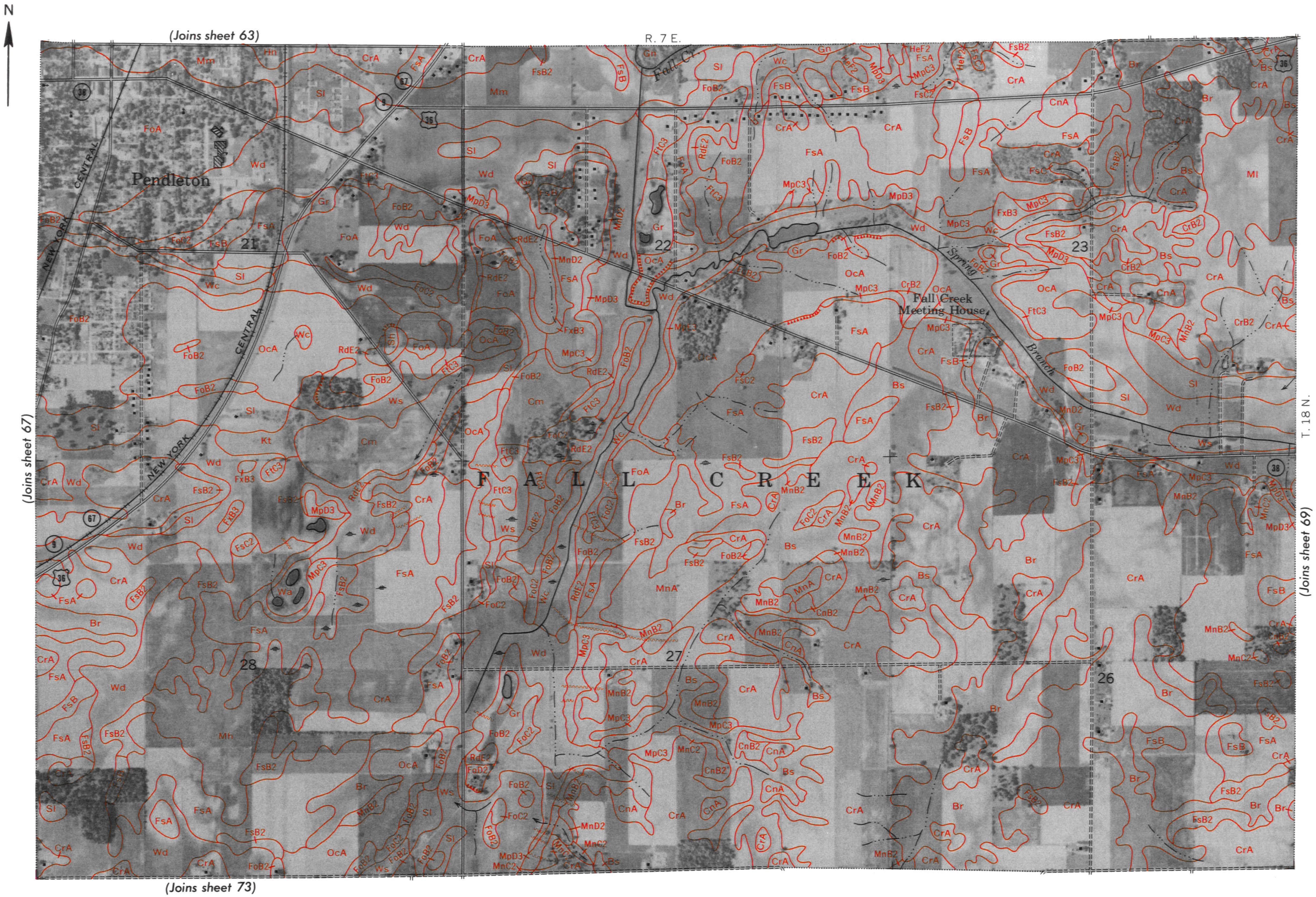
0 ½ Mile Scale 1:15840 0 3000 Feet

This map is one of a set compiled in 1966 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Purdue University Agricultural Experiment Station.

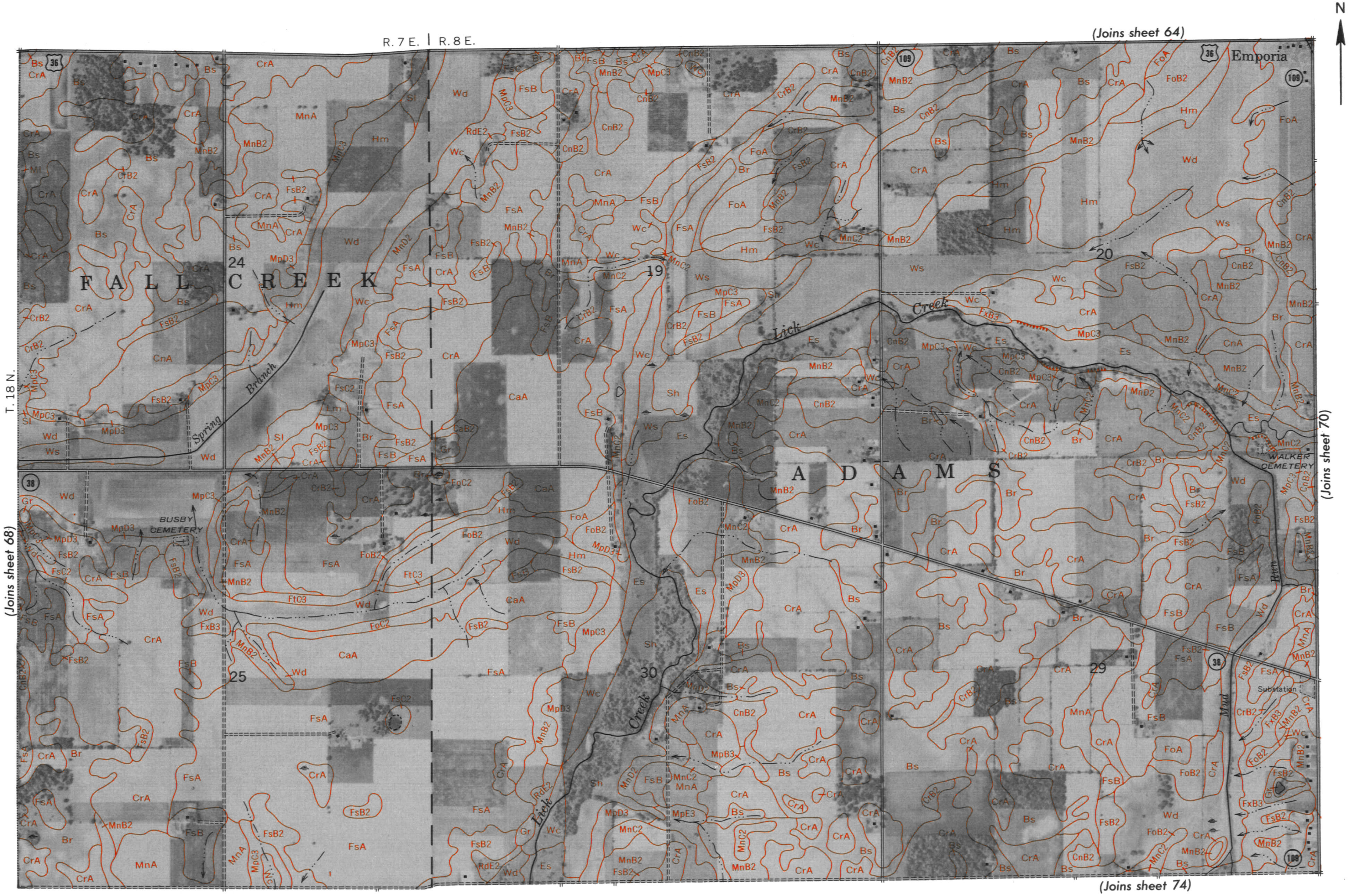
Range, township, and section corners shown on this map are indefinite.



0 ½ Mile Scale 1:15840 0 3000 Feet



0 ½ Mile Scale 1:15840 0 3000 Feet



0 ½ Mile Scale 1:15840 0 3000 Feet

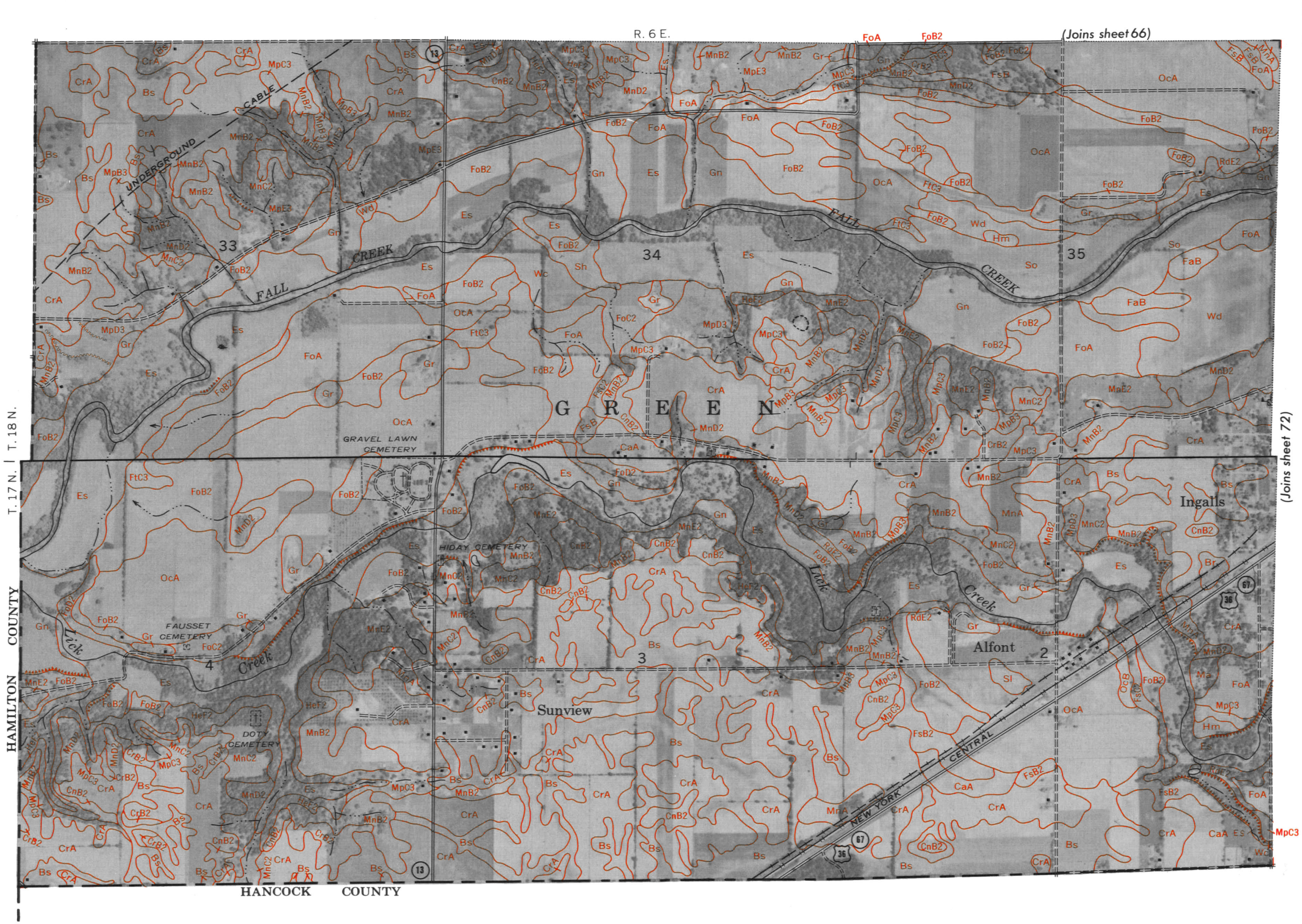
This map is one of a set compiled in 1966 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Purdue University Agricultural Experiment Station.

Range, township, and section corners shown on this map are indefinite.

MADISON COUNTY, INDIANA — SHEET NUMBER 70

This map is one of a set compiled in 1966 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Purdue University Agricultural Experiment Station.

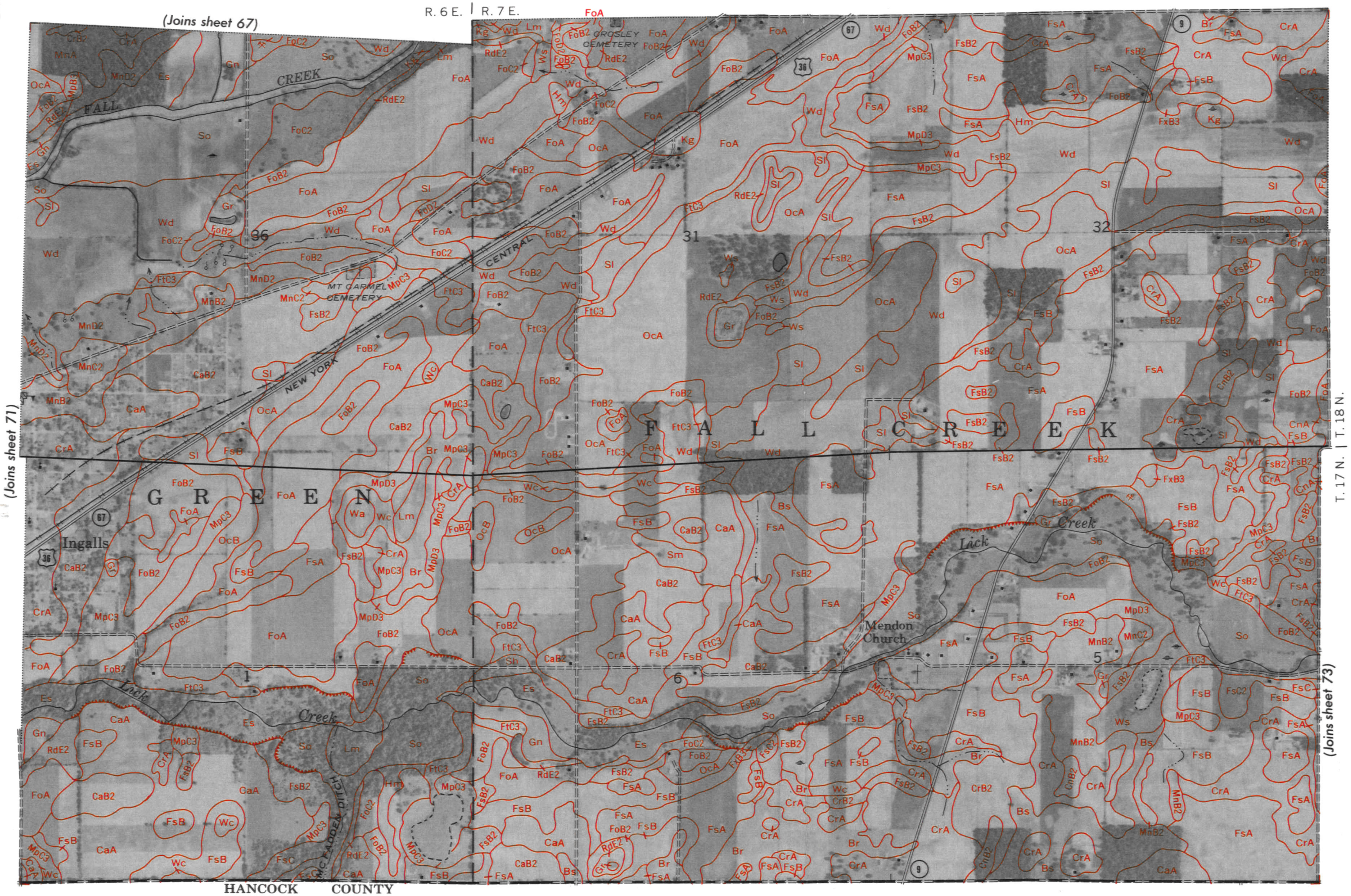
Range, township, and section corners shown on this map are indefinite.



0 ½ Mile Scale 1:15840 0 3000 Feet

MADISON COUNTY, INDIANA — SHEET NUMBER 72

N

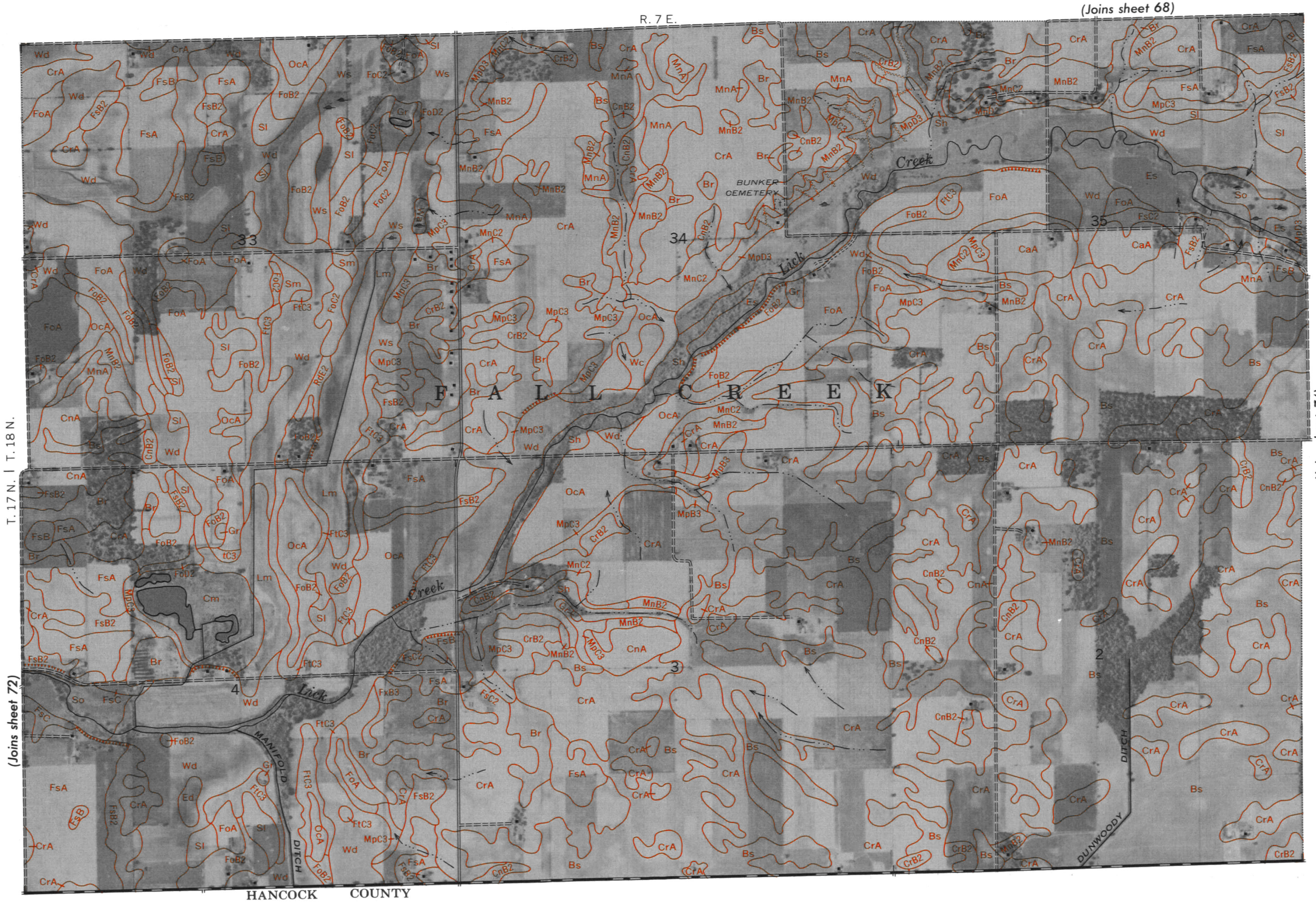


0 ⅜ Mile Scale 1:15840 0 3000 Feet

This map is one of a set compiled in 1966 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Purdue University Agricultural Experiment Station.

Range, township, and section corners shown on this map are indefinite.

N



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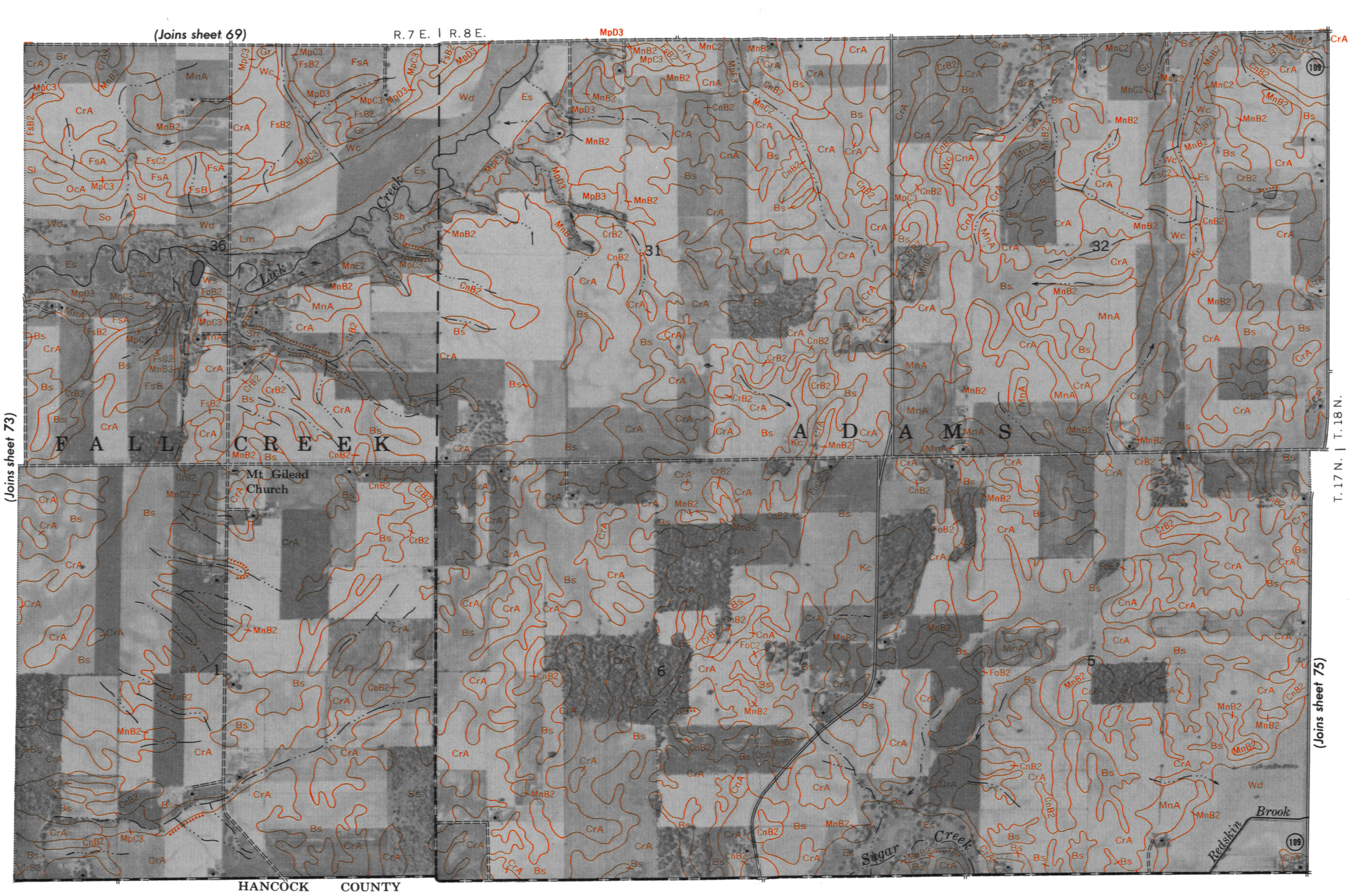
MADISON COUNTY, INDIANA — SHEET NUMBER 74



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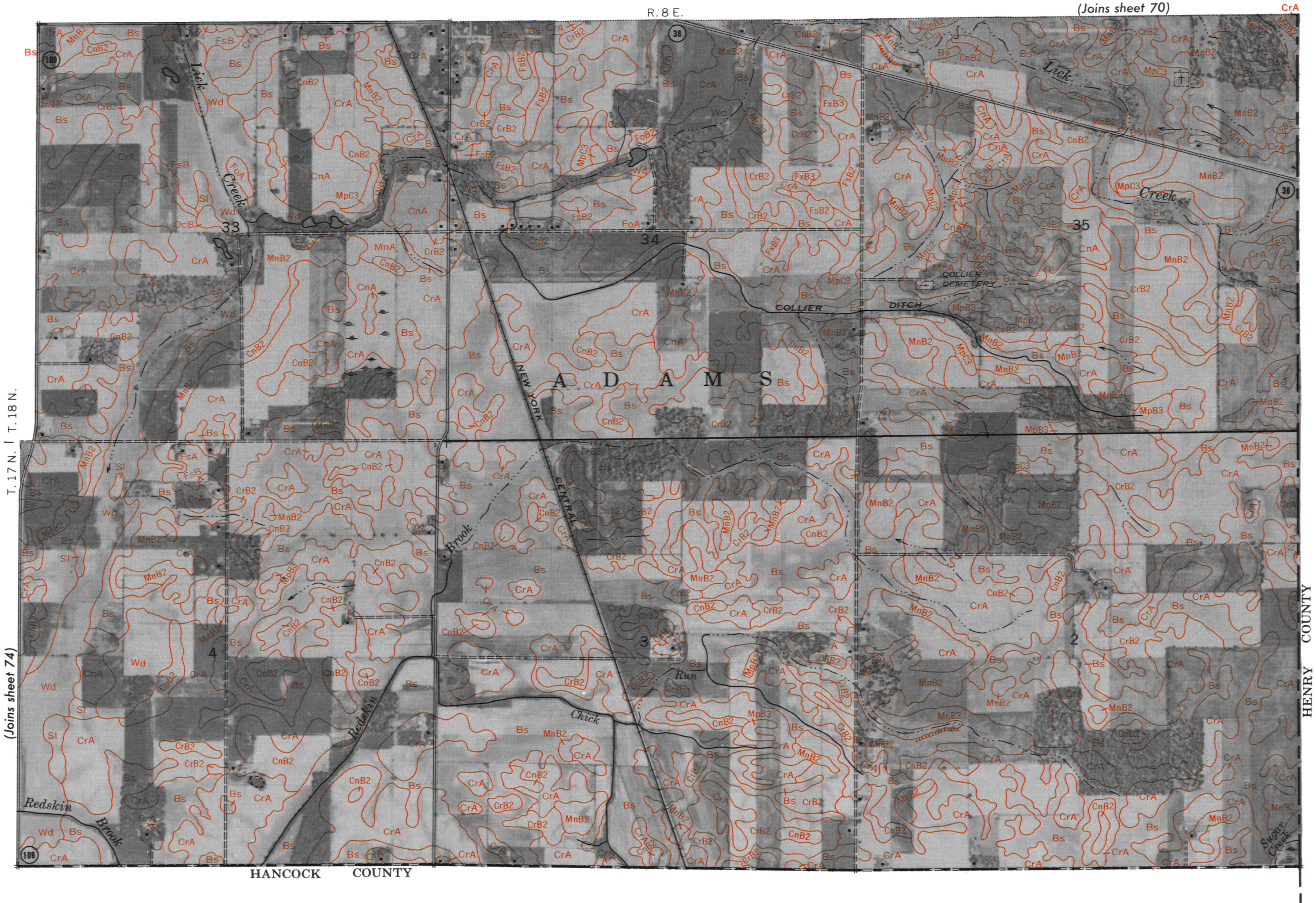

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0 ½ Mile Scale 1:15840 0 3000 Feet